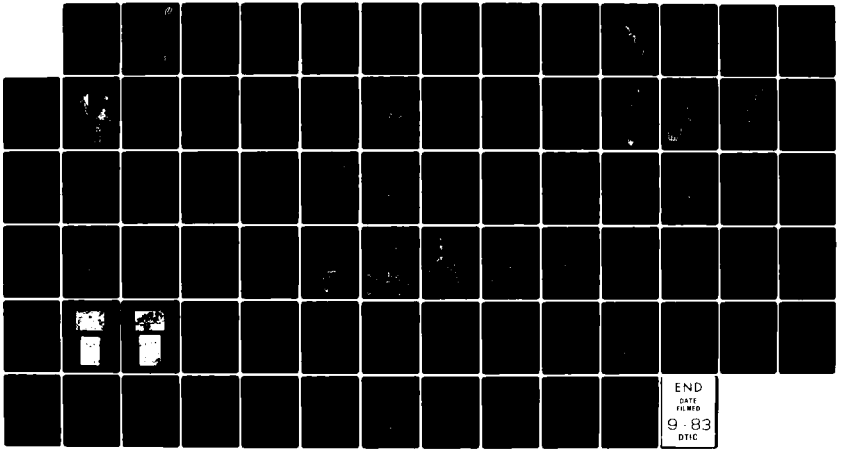
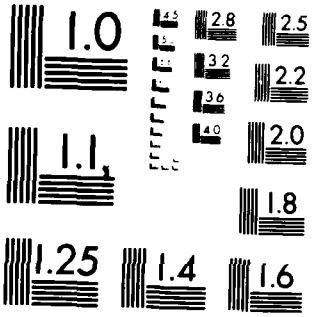
AD-A131 186 INVENTORY OF ENDANGERED PLANTS SAINT LOUIS DISTRICT(U) 1/1
BIOTIC CONSULTANTS INC CARBONDALE IL R MOHLENBROCK
1977 LMSSD-77-327

UNCLASSIFIED F/G 6/3 NL



END
DATE FILMED
9-83
DTIC



Inventory of Endangered Plants

St. Louis District

Prepared by

Biotic Consultants, Inc.

1977

Prepared under Contract No. LMSSD77-327

U. S. Army Engineer District, St. Louis

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Inventory of Endangered Plants St. Louis District		5. TYPE OF REPORT & PERIOD COVERED Inventory of Endangered Plants, 1977 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Mohlenbrock, Robert		8. CONTRACT OR GRANT NUMBER(s) LMSSD 77-327
9. PERFORMING ORGANIZATION NAME AND ADDRESS Biotic Consultants, Inc. Carbondale, Illinois		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engr. District, St. Louis 210 Tucker Blvd., North St. Louis, Missouri 63101		12. REPORT DATE 1977 13. NUMBER OF PAGES 100
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) Same		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Unlimited

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

Unlimited

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Endangered species, Illinois, Missouri Floodplain vegetation, Endangered plants

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report documents the possible existence of seven species of endangered plants nominated by a panel of botanists in Missouri and Illinois.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Inventory of Endangered Plants

St. Louis District

Prepared by

Biotic Consultants, Inc.

1977

Prepared under Contract No. LMSSD77-327

U. S. Army Engineer District, St. Louis

Contents

Inventory of Endangered Plants

St. Louis District

On December 28, 1973, Public Law 93-205, known as the Endangered Species Act of 1973, was approved by Congress. The Act brought into focus the need for preventing indiscriminate destruction of the vegetation of this country. It pointed out that "once a species of plant is extinct, the potential contained in that gene pool is lost forever" and that "a diversity of plant species is required . . . to maintain an ecological stability in the biosphere."

Among other things, the Endangered Species Act of 1973 directed the Smithsonian Institution to prepare a list of endangered and threatened plant species, to review methods of adequately conserving these species, and to report the Institution's recommendations to the Congress.

The Smithsonian program, under the direction of Dr. Edward S. Ayensu, and with the assistance of botanists and interested organizations, was concluded with a report submitted to Congress on 15 December 1974. This "Report on Endangered and Threatened Plant Species of the United States" listed 1238 threatened species, 761 endangered species, and 100 recently extinct or possibly extinct species.

Recommendation 1 of this report stated that "preservation of endangered and threatened species of plants in their native habitat should be adopted as the best method of ensuring their survival." Since destruction of critical habitats of endangered species by human activities would probably result in reduction in population, it is essential that all agencies be aware of the location of these critical habitats.

Recommendation 2 stated that "the species of endangered and threatened plants that occur on federal and state lands should be mapped and given continued protection." The Smithsonian report comments further that "Federal agencies that are involved in land management should be reminded that endangered and threatened plant species and their supporting habitats are basic natural resources in the agencies' land use plans and in their natural resource surveys or inventories."

The Smithsonian report listed two endangered species which are known to occur in the St. Louis District (Draba aprica, Isotria medeoloides) and 12 threatened species in the District (Asclepias meadii, Boltonia asteroides var. decurrens, Apios priceana, Synandra hispidula, Cypripedium candidum, Platanthera flava, Platanthera leucophaea, Platanthera peramoena, Muhlenbergia X curtisetosa, Asplenium X kentuckiense, Dodecatheon frenchii, Rubus missouricus).

The Endangered Species Act of 1973 further stipulated, in Section 4, that the Secretary of the Interior should review the lists in the Smithsonian Report and publish proposed lists of endangered and threatened plants in the Federal Register.

In accordance with this recommendation, the Fish and Wildlife Service of the Department of the Interior released a report in the Federal Register of 16 June 1976 (pp. 24524 - 24572). This publication issues a proposed rulemaking which would determine about 1700 native taxa of vascular plants of the United States as Endangered Species.

Preliminary to the report of 16 June 1976, the Director of the U. S. Fish and Wildlife Service published a notice in the Federal Register of 22 April 1975, describing the process of determination of "Critical Habitat" for Endangered and Threatened Species. The Director of the U. S. Fish and Wildlife Service published another notice in the Federal Register of 1 July 1975, announcing the initiation of a review of the status of the plant taxa named in the Smithsonian report.

The 1700 taxa in the proposed list of 16 June 1976 represent a portion of the Smithsonian list and were assembled on the basis of comments and data received by the Smithsonian Institution and the U. S. Fish and Wildlife Service.

In determining the Federal list of Threatened and Endangered Species, the entire range of the species was considered. A species that is rare in one area was not included if it is common elsewhere in its range. The following definitions are used for Endangered and Threatened Species:

Endangered Species: Those species of plants in danger of extinction throughout all or a significant portion of their ranges. Existence may be endangered because of the destruction, drastic modification, or severe curtailment of habitat, or because of over-exploitation, disease, predation, or even unknown reasons. Plant taxa from very limited areas, e.g., the type localities only, or from restricted fragile habitats, usually are considered endangered.

Threatened Species: Those species of plants that are likely to become endangered within the forseeable future throughout all or a significant portion of their ranges. This includes species categorized as rare, very rare, or depleted.

The list of 16 June 1976 included only vascular plants: angiosperms (flowering plants), gymnosperms (pines and relatives), and pteridophytes (ferns). The lower plant groups--algae, fungi, lichens, mosses, and liverworts--were not included.

Only endangered species were included in the 16 June 1976 list. Of the 1700 entries, the following were listed from Illinois and Missouri:

Asclepias meadii - Mead's Milkweed - Illinois, Missouri
Draba aprica - Whitlow-grass - Missouri
Lesquerella filiformis - Bladderpod - Missouri
Thismia americana - Thismia - Illinois
Geocarpon minimum - Geocarpon - Missouri

Cyperus grayioides - Umbrella Sedge - Illinois
Apios priceana - Price's Groundnut - Illinois
Lespedeza leptostachya - Prairie Bush-clover - Illinois
Petalostemum foliosum - Prairie Clover - Illinois
Castanea ozarkensis - Ozark Chinquapin - Missouri
Iliamna remota - Kankakee Mallow - Illinois
Isotria medeoloides - Small Whorled Pogonia - Illinois
Plantago cordata - Heart-leaved Plantain - Illinois, Missouri
Calamagrostis insperata - Reed Bent Grass - Missouri
Heuchera missouriensis - Missouri Alumroot - Missouri

Scope of this Report

The contractor has endeavored to ascertain which of the fifteen species of endangered plants on the Federal list of 16 June 1976 occur within the St. Louis District, U. S. Army Corps of Engineers. He has contacted biologists in the bi-state area, asking for locations of extant populations of the species. (A list of correspondents is appended to this report.)

Herbarium material of these species was examined from several herbaria in Missouri and Illinois. Among those herbaria examined were the Missouri Botanical Garden, the University of Missouri at Columbia, the Illinois State Museum, the Field Museum of Natural History, and Southern Illinois University at Carbondale. Specimens of Apios priceana were also studied from the University of Tennessee, Vanderbilt University, the New York Botanical Garden, the Gray Herbarium, and the University of Illinois. The contractor expresses deepest gratitude to those who assisted in the study.

After localities were ascertained from correspondents and from herbarium study, an attempt was made to relocate the species in question.

Of the fifteen species listed from Illinois and Missouri in the Federal list of 16 June 1976, six were found to occur within the boundaries of the St. Louis District, U. S. Army Corps of Engineers. These are Apios priceana, Asclepias meadii, Cyperus grayioides, Draba aprica, Isotria medeoloides, and Plantago cordata. A seventh one, Heuchera missouriensis, which approaches to within seven miles of the District, is given full treatment in this study.

Each of these species has been observed and studied throughout one or more years at various stations in the study area. (Mr. Mike Homoya has provided some of the life history data for Isotria medeoloides). Accounts of the life history of each species, together with ecological and distributional data, are given. County highway maps showing extant localities as well as localities where a species had occurred at one time have been prepared for each species. Speculation on methods to preserve each species has been included. Color photographs have been made where feasible, and detailed line drawings of each species have been prepared.

The eight species from Illinois and Missouri on the Federal list which were not found to occur in or adjacent to the St. Louis District are briefly described and mapped, showing their bi-state distribution.

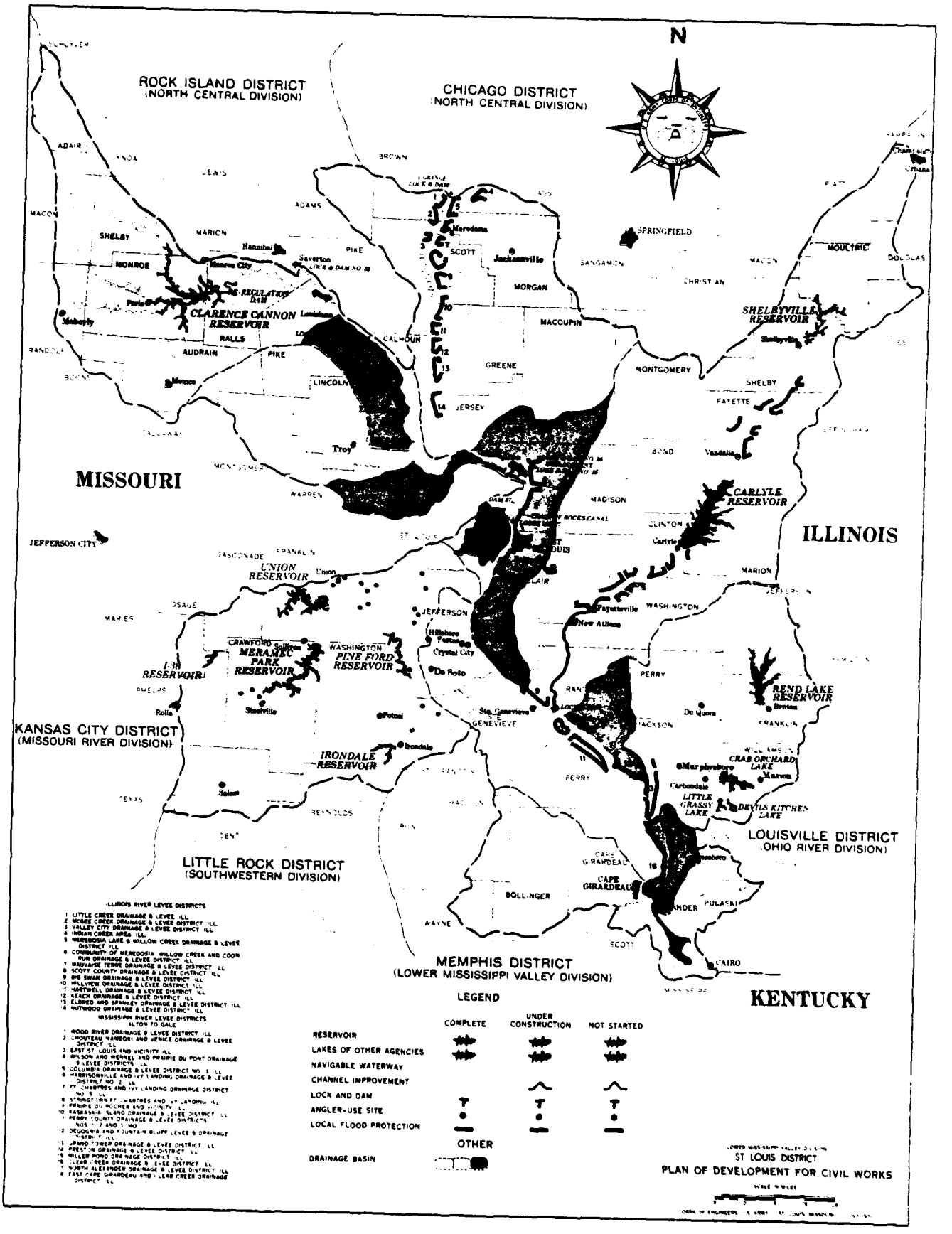
The contractor also asked botanists in the two-state area to nominate other species for possible inclusion in future lists of threatened and endangered species. Three species are considered in this category, and each is discussed in this report. They are Boltonia decurrens, Carex socialis, and Rubus missouricus.

Location of the Study Area

The study area encompasses that area referred to as the St. Louis, Missouri, Corps of Engineers District. The St. Louis District contains approximately 26,000 square miles almost equally divided in area and population between eastern Missouri and western Illinois. It includes the Mississippi River and its tributary basins, except the Missouri River Basin, from the mouth of the Ohio River to river mile 300 near Saverton, Missouri, and the lower 80 miles of the Illinois River.

Objective

The purpose of this inventory is to document the distribution and life history of those vascular plant species which are found in the St. Louis District and designated as endangered under the auspices of the Endangered Species Act of 1973 (Public Law 93-205) by the Department of the Interior, Fish and Wildlife Service (Federal Register, 16 June 1976, Vol. 41, No. 117, part IV, pp. 24524-24572). This inventory will be used as a planning document for environmental assessment work associated with proposed water resource development projects being studied by the St. Louis District.


N
ROCK ISLAND DISTRICT
(NORTH CENTRAL DIVISION)
CHICAGO DISTRICT
(NORTH CENTRAL DIVISION)
MISSOURI
ILLINOIS
KENTUCKY
KANSAS CITY DISTRICT
(MISSOURI RIVER DIVISION)
LITTLE ROCK DISTRICT
(SOUTHWESTERN DIVISION)
MEMPHIS DISTRICT
(LOWER MISSISSIPPI VALLEY DIVISION)
LOUISVILLE DISTRICT
(OHIO RIVER DIVISION)
CLARENCE CANNON RESERVOIR
SHELBYVILLE RESERVOIR
CARLYLE RESERVOIR
UNION RESERVOIR
MERAMEC PARK RESERVOIR
PINE FORD RESERVOIR
I-38 RESERVOIR
IRONDALE RESERVOIR
REND LAKE RESERVOIR
CRAB ORCHARD LAKE
LITTLE GRASSY LAKE
DEVILS KITCHEN LAKE
JEFFERSON CITY
SPRINGFIELD
CAPE GIRARDEAU
CAIRO
LEGEND
COMPLETE
UNDER CONSTRUCTION
NOT STARTED
RESERVOIR
LAKES OF OTHER AGENCIES
NAVIGABLE WATERWAY
CHANNEL IMPROVEMENT
LOCK AND DAM
ANGLER-USE SITE
LOCAL FLOOD PROTECTION
OTHER
DRAINAGE BASIN
ILLINOIS RIVER LEVEE DISTRICTS
MISSISSIPPI RIVER LEVEE DISTRICTS
ST LOUIS DISTRICT
PLAN OF DEVELOPMENT FOR CIVIL WORKS

Endangered Species of the St. Louis District

Price's Groundnut

(Apios priceana Robinson)

This species is a climbing member of the pea family. It is extremely uncommon in its overall range and, consequently, little has been written about it. It is considered Endangered in the Federal list of 16 June 1976.

History and General Distribution

Sarah Frances "Sadie" Price, a venerable Kentucky botanist, discovered this unusual species near Bowling Green, Warren County, Kentucky, during the summer of 1895. Not recognizing its identity, she sent it to Professor B. L. Robinson at Harvard University who realized it was new to science. He commemorated Sadie Price by naming it Apios priceana. Sadie Price collected this species from the same locality several times in 1896 and 1897.

This species had been found earlier, but it was not recognized as a different species from the more widespread Apios americana. George L. Ames had found this same species in Decatur County, Tennessee, on August 4, 1855.

H. K. Svenson collected Apios priceana on July 24, 1935, on a dry hillside at Bull Run, west of Nashville, Davidson County, Tennessee.

On July 22, 1938, H. K. Svenson and J. M. Shaver found this species along Little Marrowbone Creek near Nashville, Davidson County, Tennessee.

Dr. George D. Fuller of the Illinois State Museum found the first Illinois station of Apios priceana at Wolf Lake, Union County, on September 8, 1941. He, also, mistook it for Apios americana.

The next record of this species is from Mississippi when, on July 9, 1956, James D. Ray, Jr., found it six miles north of Starkville in Oktibbeha County.

Mr. Raymond Athey, an amateur botanist from Paducah, Kentucky, discovered this species in Lyon County near the Confederate Cemetery on July 11, 1969. He subsequently collected from this same station several times.

John Schwegman found it in Livingston County, Kentucky, 1.2 miles northwest of Carrsville, in 1967.

In September, 1976, the contractor re-located the Union County, Illinois, station at the north end of Wolf Lake where the lake merges into the swampy area known locally as the "Scatters."

Life History

Apios priceana is a climbing, perennial vine. The pinnately compound leaves begin to expand between March 25 and April 6, maturing in several days. (Much of the life history which follows is based on observations of the Lyon County, Kentucky, population.)

Flowers have been observed in bloom as early as July 6 and as late as September 18, although most other flowers by September 18 had withered. The lowest flowers of the inflorescence bloom first, with the last flowers to open being the terminal ones. It may take up to six weeks for all the flowers in an inflorescence to open.

Approximately one to two months elapse from the time a flower opens until a mature legume is formed which contains ripe seeds. Dehiscence of the legume occurs shortly after maturity. Open and empty legumes persist on the vines until at least mid-November.

Description

Herbaceous perennial vine from a single tuber; tuber up to reportedly 20 cm thick. Stems slender, climbing, glabrous. Leaves alternate, pinnately compound, with 5-7 leaflets; leaflets lance-ovate to lanceolate, acute at the apex, rounded or tapering to the base, entire glabrous, up to 5.5 cm long, up to half as wide, short-petiolulate. Inflorescence a dense, pyramidal raceme, up to 20-flowered; flowers rose or occasionally apparently greenish-white tinged with purple, up to 2 cm long; calyx cup-like, seemingly 1-lobed, up to 10 mm long; standard petal prominent, with a swollen, spongy projection at the tip; stamens 10. Legume narrow, flat, up to 10 cm long, twisting after dehiscence, several-seeded.

Taxonomy

Apios priceana is one of two species of the genus Apios occurring in the eastern United States. The two species are so similar vegetatively that it is most difficult to distinguish them unless flowers are present. In flower, however, the two are readily differentiated. The calyx in A. priceana is about twice as long as in A. americana, and the corolla is usually rose in A. priceana, rather than purple-brown. The peculiar spongy projection at the tip of the standard petal in A. priceana is distinctive.

Collections Seen

The contractor has seen the following collections of this species:

Tennessee: Decatur Co., August 4, 1855, G. L. Ames.
Kentucky: Bowling Green, Warren County, 1895, S. F. Price.

Kentucky: Bowling Green, Warren County, July 12, 1896, S. F. Price.
Kentucky: Same as above, July and August, 1896, S. F. Price.
Kentucky: Near Bowling Green, Warren County, July - September, 1896, S. F. Price.
Kentucky: Warren County, August, 1897, S. F. Price.
Tennessee: Bull Run, west of Nashville, Davidson County, July 24, 1935, H. K. Svenson 7325.
Tennessee: Little Marrowbone Creek, near Nashville, Davidson County, July 22, 1938, H. K. Svenson & J. M. Shaver 9616.
Illinois: Wolf Lake, Union County, September 8, 1941, G. D. Fuller 664.
Mississippi: Facing Trim Cane Creek floodplain, 6 miles north of Starkville, July 9, 1956, James D. Ray, Jr. 6728.
Kentucky: Lyon County, near the Confederate Cemetery, July 11, 1969, R. Athey 771; also August 11, 1969, and September 19, 1969.
Kentucky: Livingston County, 1.2 miles northwest of Carrsville, July 30, 1967, J. Schwegman 1334.

Habitat

Apios priceana grows in open oak woods, cut-over woods, and damp thickets. It occurs in low woods at its only station in the St. Louis District. At this locality, it is associated with giant cane (Arundinaria gigantea), species of beggar's-ticks (Bidens spp.), species of smartweed (Polygonum spp.), iris (Iris shrevei), and others. Swamp holly (Ilex decidua) is in the shrub layer. Overstory trees include pin oak (Quercus palustris), red maple (Acer rubrum), and cottonwood (Populus deltoides).

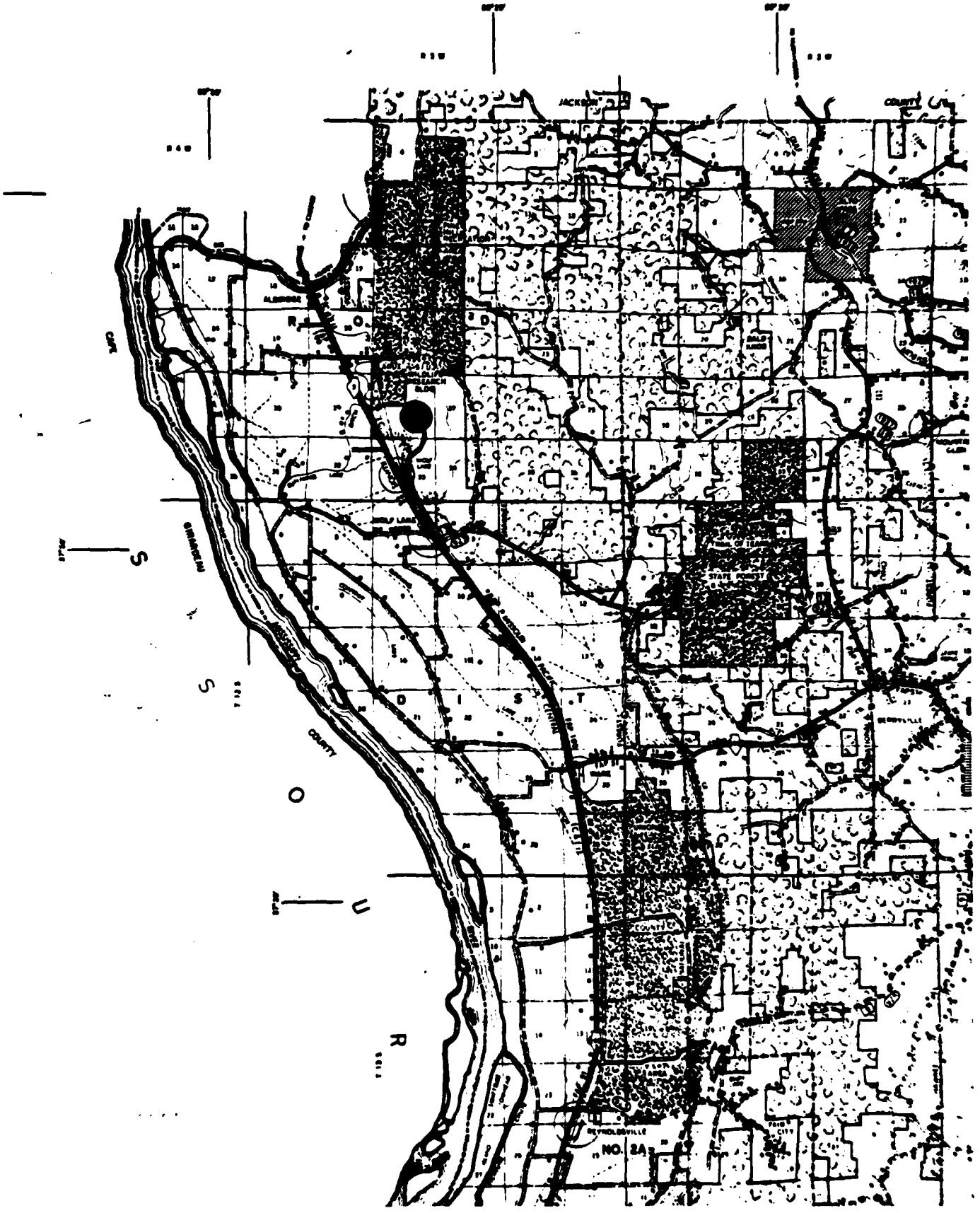
Distribution and Status in the St. Louis District

Only a single location is known for this species in the St. Louis District, U. S. Army Corps of Engineers. The station is in a low woods immediately north of Wolf Lake, in western Union County, Illinois. This type of woods is found extensively in the Wolf Lake-LaRue area. Other locations may subsequently be found for this species.

Because of its occurrence at such a low elevation, any raising of the water level in the surrounding area would doubtless have detrimental effects on this species. Hunters who frequent the area probably have no damaging effect on this population.

Price's Groundnut (Apios priceana). (Left), leaves and flower clusters; (Right), fruits.

Portion of Union County, Illinois, showing locality of Apios priceana.



Mead's Milkweed

(*Asclepias meadii* Torrey)

This milkweed has a limited distribution, primarily in prairies of northwestern Indiana, southwestern Wisconsin, northern Illinois, Iowa, Missouri, and eastern Kansas. Several areas where this plant once existed no longer support this species. It is considered Endangered in the Federal list of 16 June 1976.

History and General Distribution

Dr. Samuel B. Mead originally discovered this species during the 1840's near Augusta, Hancock County, in east-central Illinois. Subsequent early collections in Illinois were made in Henderson, Fulton, and Peoria counties. In more recent years it has been discovered in LaSalle, Menard, Ford, Saline, and Cook counties. The Cook County station at Palatine, found in 1966, is now destroyed, according to Swink (1974). The Saline County station, discovered in 1953, is just outside the St. Louis District, U. S. Army Corps of Engineers. No Illinois stations fall within the St. Louis District.

The Indiana locality was discovered on July 3, 1888, by Bannon near Crown Point, Lake County.

There are eleven counties in Missouri where this species has been found. Most of these counties are either in the west-central part of the state, or in the uppermost tier of counties. Only two collections have been made in the St. Louis District. One of these represents the first known specimen ever found of this species. It was collected in May, 1833, in open woods in St. Louis, by George Engelmann (#459). The true identity of this plant remained unknown until after John Torrey described *Asclepias meadii* in 1856.

Colton Russell collected this species on Buzzard Mountain, Iron County, on June 10, 1898. Both the St. Louis and Iron County stations are apparently extinct since visits to these areas have not resulted in the rediscovery of *A. meadii*.

Some stations in west-central Missouri are still extant. One of these localities is in Friendly Prairie, 9 miles south of Sedalia, in Pettis County. This locality, although not in the St. Louis District, is only a few miles distant.

Asclepias meadii has been found in one county in southwestern Wisconsin, five counties in Iowa, and six counties in eastern Kansas and one in central Kansas. Of these known localities, only nine may be extant (communication with Dr. Robert Betz).

Life History

(The following account of Asclepias meadii is based on observations of the plants which occur in Saline County, Illinois.)

The first evidence of this plant in the spring generally occurs between April 11 and 23. Growth is relatively slow until the plant is about 3 inches tall. After this, the plants begin to lengthen rather rapidly and have attained a height of 4.0 to 5.5 dm by May 15 to June 3. The green and purple flowers have been observed in anthesis between May 21 and June 18. At the time of anthesis, the leaves of this plant have attained their maximum size. Individual flowers persist for 5 to 7 days.

Young fruits can be observed by late June. Only a single fruit develops from an inflorescence. By late August and early September, the fruits are mature and from 4-8 cm long. The seeds ripen from mid-September to mid-October. Natural dehiscence of the fruit occurs between September 8 and October 12. The seeds are windblown. (During 1976, the fruits at the Saline County station failed to produce ripened seeds.) By early November, the specimens have died back. The contractor has been unable to germinate seeds of this species.

Description

Perennial herb. Stems erect, up to 5.5 dm tall, unbranched, slender, glabrous, glaucous. Leaves opposite, usually 3-4 pairs per stem, broadly lanceolate, pointed at the tip, rounded at the base, sessile, entire but rough to the touch along the edges, up to 6 cm long. Inflorescence a terminal umbel on a long stalk, 6- to 15-flowered; sepals 5, green, reflexed, hidden by the petals; petals 5, reflexed, greenish-white, up to 10 mm long; hoods erect above the petals, purplish or greenish-purple, up to 8 mm long, with a short, stout horn protruding from the middle, with a sharp tooth along each side. Fruit a follicle, slender, tapering to the tip, up to 8 cm long. Seeds with a tuft of hairs.

Taxonomy

There is little doubt as to the taxonomic status of this species, since it stands apart from nearly all other milkweeds. It is apparently most closely related to Asclepias amplexicaulis Sm.

Known Localities (by counties)

(Much of the following data has been given by Dr. Robert Betz.)

Indiana: Lake (before 1910).
Illinois: Cass (before 1910), Cook (now destroyed), Ford, Fulton (before 1910), Hancock (before 1910), Henderson (before 1910), LaSalle (before 1910), Peoria (before 1910), Saline.

Wisconsin: Grant (before 1910).
Iowa (all before 1910): Adams, Clinton, Decatur, Emmet, Scott.
Missouri: Benton (before 1910), Cass (before 1910), Henry, Iron (before 1910), Jackson (before 1910), Johnson, Pettis, Polk, Putnam (before 1910), Scotland (before 1910), St. Louis (before 1910).
Kansas: Allen (before 1910), Anderson, Brooks (before 1910), Douglas (before 1910), Franklin, Jefferson, Miami (before 1910).

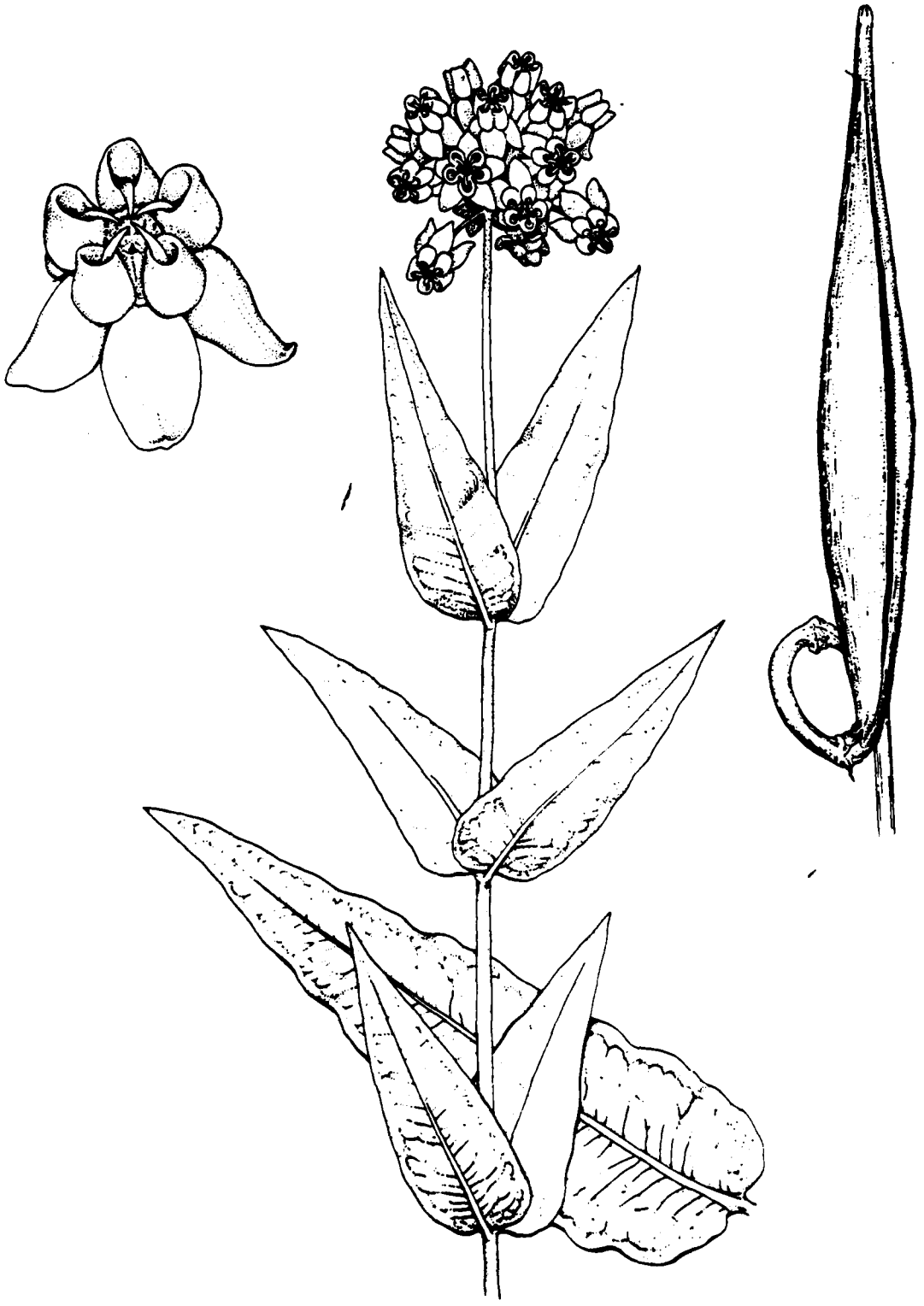
Habitat

Asclepias meadii is found in prairies, glades, open woods, and dry exposed ground. The station at Saline County, Illinois, is in a small hill prairie atop a sandstone cliff. Associated species at this locality are the white prairie clover (Petalostemum candidum), prairie parsley (Polytaenia nuttallii), pencil-flower (Stylosanthes biflora), perideridia (Perideridia americana), june grass (Koeleria macrantha), and poverty oat grass (Danthonia spicata).

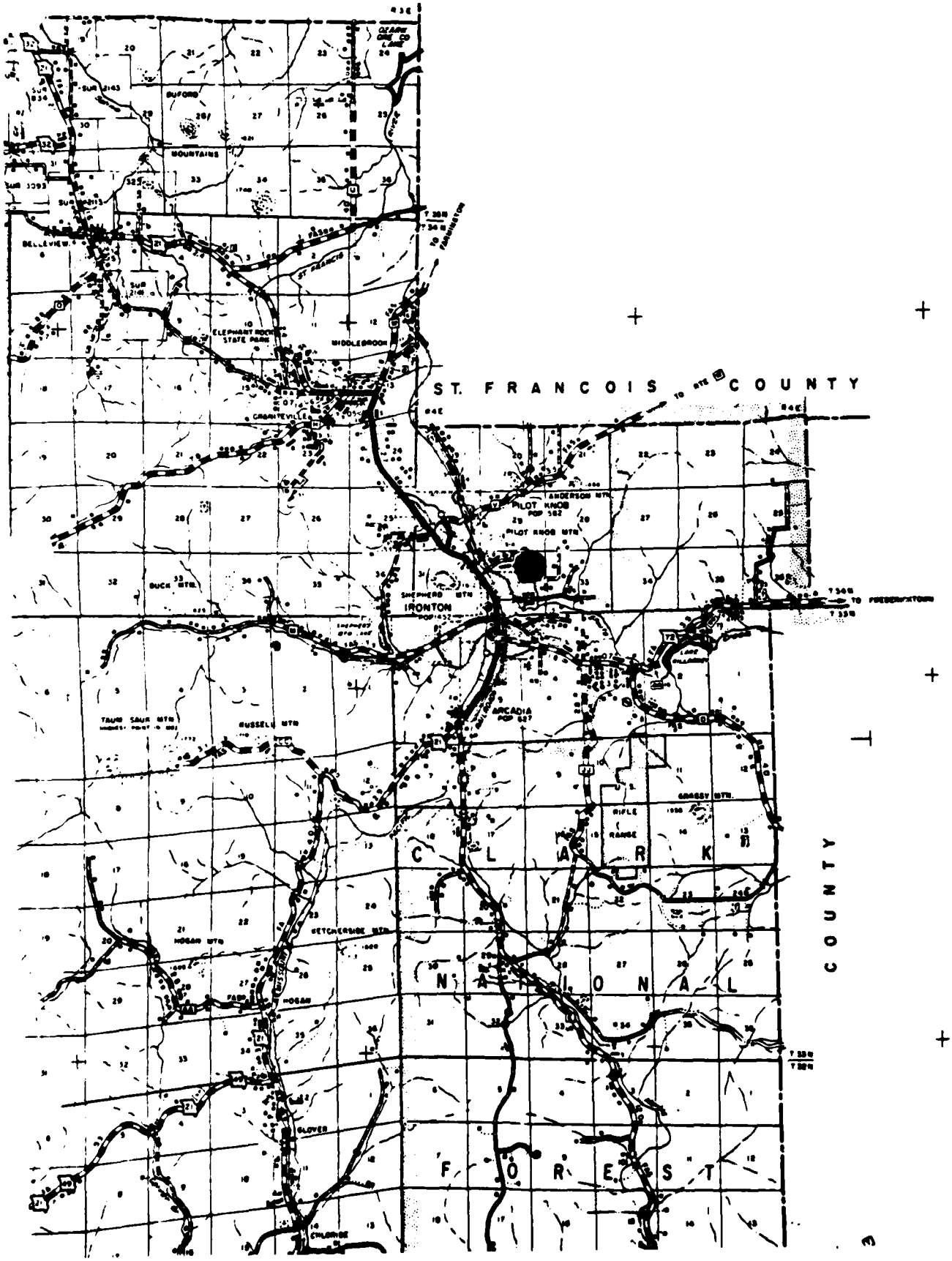
Distribution and Status in the St. Louis District

There have been only two collections of this species from the St. Louis District, one in 1833 and one in 1898. An attempt by the contractor to relocate this species in the St. Louis area has been futile. It appears that this species now is extinct in the St. Louis District.

Mead's Milkweed (Asclepias meadii). (Left), flower; (Center), habit; (Right), fruit.



Portion of Iron County, Missouri, showing early locality of Asclepias meadii.



Sand Cyperus

(Cyperus grayioides Mohlenbrock)

This sand-inhabiting species of the sedge family is known from sand prairies in west-central and northwestern Illinois. It is considered Endangered in the Federal list of 16 June 1976.

History and General Distribution

This is one of the more recently named species, being described by Mohlenbrock in 1959. Before Mohlenbrock's determination that this was, indeed, a new species, it had been identified as Cyperus bushii, C. filiculmis X schweinitzii, and C. schweinitzii.

The first collection was made on August 13, 1903, by Henry Allen Gleason near Havana, Mason County, Illinois. It has been found in the same area several times subsequently, with a number of collections made by Rollo T. Rexroat.

Robert A. Evers found it in a sand prairie north of Fulton, Whiteside County, Illinois, on August 15, 1952.

On August 20, 1976, John Schwegman collected this species four miles south of Beardstown, Cass County, Illinois.

There is an immature specimen in the herbarium of the Missouri Botanical Garden, collected in Hardin County, Texas, on September 10, 1937, by B. C. Tharp, that may prove to be this species.

The Cass County station is within the boundaries of the St. Louis District.

Life History

Cyperus grayioides is a perennial which has short rhizomes with rows of small tubers attached.

The unbranched stems (culms) are generally first observed in early May. They make steady growth and produce a few slender, folded leaves during May. The stems and leaves elongate and reach maximum length by late June.

An inflorescence is borne from the top of each culm. Several bracts begin elongating in late June and early July. Immature spikes can be observed in the axils of the bracts at the same time.

All but one of the heads in each inflorescence are borne on slender, stiff, ascending peduncles. While these peduncles are elongating during

July and early August, the spikes which terminate them are maturing.

One spike remains sessile in the axils of the bracts and usually develops to a larger size than the other spikes.

All spikes generally mature at about the same time, usually during the second and third weeks of August.

The achenes, which are black when ripe, fall as the scales of the spikes "loosen" on becoming dry. By the second week in September, most of the achenes have been dispersed.

Description

Perennial; rhizome short, bearing moniliform tubers; stems (culms) 30-60 cm tall, 0.7-1.2 mm broad, glabrous; leaves folded lengthwise, 2.0-3.5 mm wide, glabrous, shorter than the stem; inflorescence with 3-8 rays subtended by 4-7 folded bracts; spikes spherical, numerous, with the spikelets radiating in all directions; spikelets 4- to 7-flowered, up to 10 mm long; scales loosely imbricate, obtuse, or the terminal scale acute, 9- to 13-nerved, 2.2-2.8 mm long; rachilla wingless; stamens 3; style 3-cleft; achene trigonous, oblong, black, 2.0-2.6 mm long, apiculate.

Taxonomy

This species has its closest affinity in the midwest to Cyperus filiculmis Vahl. Cyperus grayioides differs by its spherical spikes which have spikelets radiating in all directions and by its slightly longer achenes. It looks superficially like C. grayii, a species of the eastern seaboard. Cyperus grayii, however, has the axis of each spikelet winged.

Collections Known

Because of the extreme rarity of this species, all collections known to the contractor are listed below. All have been examined in conjunction with this study, and all are from Illinois.

Mason Co.: Havana, bunch-grass association, August 13, 1903, H. A. Gleason 1047.
Whiteside Co.: Sand prairie north of Fulton, August 15, 1952, R. A. Evers 35442.
Whiteside Co.: Sand prairie north of Fulton, August 15, 1952, R. A. Evers 35459.
Mason Co.: Blow sand, August 22, 1954, R. T. Rexroat 1125 (type), 1125a.
Cass Co.: Sand dunes, about 4 miles south of Beardstown, August 20, 1976, J. E. Schwegman 2861.

In addition to the above cited collections, there is a good population of this species in the 1,460 acre Sand Prairie-Scrub Oak Nature Preserve in Mason County, Illinois.

Habitat

Cyperus grayioides grows in blow sand and in blowouts in sand prairies in west-central and in northwestern Illinois. It occurs along the Illinois River and in the Thomson-Fulton Prairie Nature Preserve in Whiteside County. It grows in bunch-grass associations.

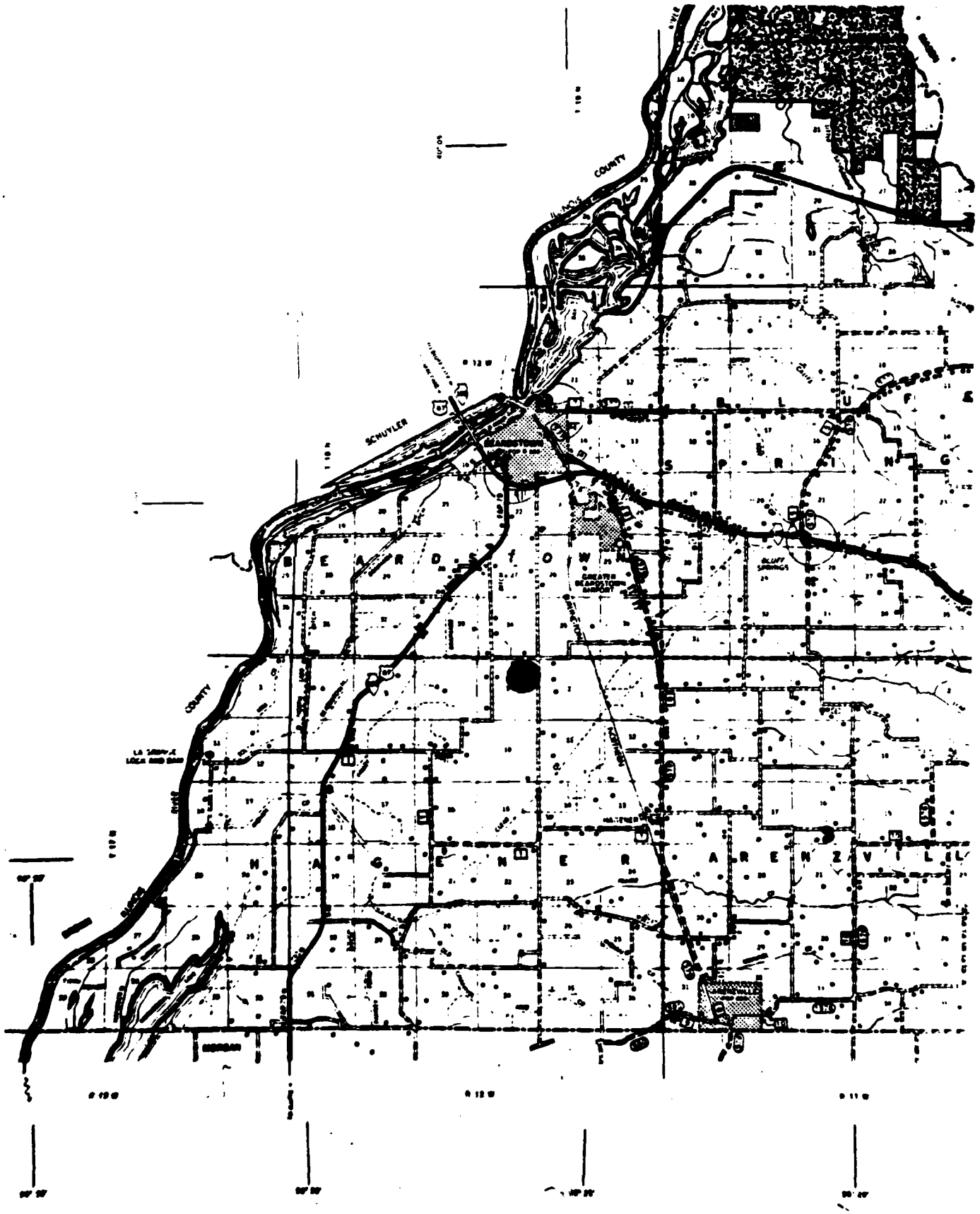
Distribution and Status in the St. Louis District

Of the four known localities of this species, one is in the St. Louis District, U. S. Army Corps of Engineers.

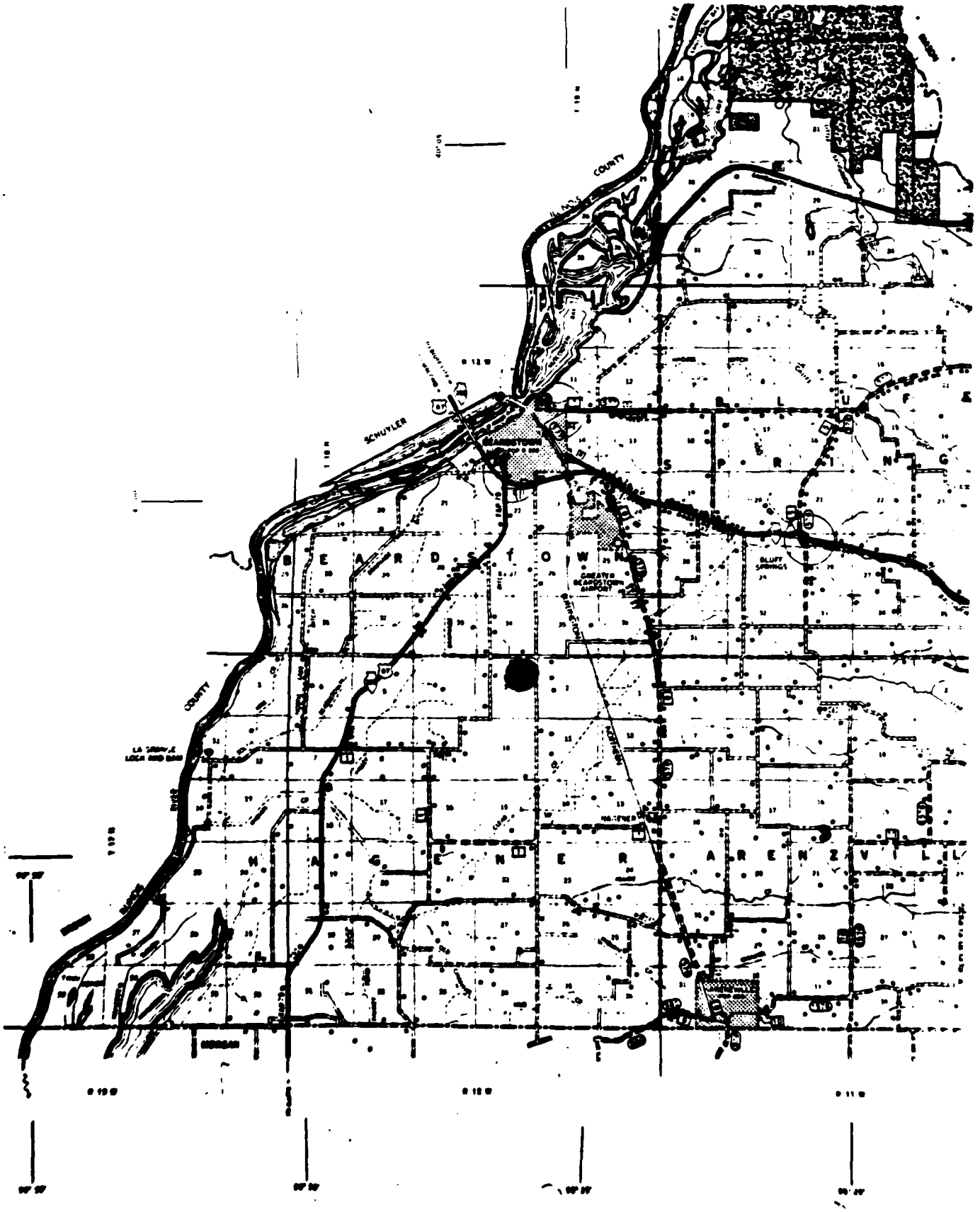
Since this species seems to have a narrow range of tolerance in that it is confined to sand prairies, any alteration of these habitats would probably cause extermination of this species. Care should be taken to preserve these habitats.

Sand Cyperus (Cyperus grayioides). (Center), habit; (Right of center), spikelet; (Lower right), seed.

Portion of Cass County, Illinois, showing approximate locality of Cyperus grayioides.



Portion of Cass County, Illinois, showing approximate locality of Cyperus grayioides.



Whitlow Grass

(Draba aprica Beadle)

This species is a member of the mustard family. It is known only from Arkansas, Georgia, Oklahoma, South Carolina, and Missouri. It is considered Endangered in the Federal list of 16 June 1976.

History and General Distribution

Thomas Nuttall, the great pioneer botanist, first discovered this rare little mustard somewhere in Arkansas in 1819. His original collection also contained specimens of the similar short-fruited whitlow grass, Draba brachycarpa, and went unnoticed and unnamed until 1838. In 1838, John Torrey and Asa Gray, in the first volume of their Flora of North America, named this new entity for Nuttall, calling it Draba brachycarpa Nutt. β (or variety) fastigiata. They felt that the specimens of the new taxon were only varietally distinct from typical D. brachycarpa, even though the new plant was larger, had shorter and more dense inflorescences, and longer, hairy fruits.

Following 1838, the new taxon went undiscovered in other areas and was virtually forgotten.

Then, on May 9, 1901, the southern botanist C. B. Beadle, exploring on Kenesaw Mountain, near Marietta, Georgia, found this same little mustard growing abundantly, although he didn't know what it was. Beadle sent specimens from Kenesaw Mountain to his colleague, John Kunkel Small, who named Beadle's new find Draba aprica in 1913, not being aware of Nuttall's earlier collection which Torrey and Gray had called D. brachycarpa var. fastigiata.

When Merritt Lyndon Fernald began work later on his revision of North American Draba, he noted the similarity between D. aprica and D. brachycarpa var. fastigiata. He talked his friend, Mrs. Lily M. Perry, into trying to rediscover the Kenesaw Mountain population of Draba aprica. Accompanied by M. C. Myers, Dr. Perry visited Kenesaw Mountain on May 5, 1934, and, after considerable search, found a small colony of the enigmatic plant. Hoping to discover additional specimens, Dr. Perry and Mr. Myers returned to Kenesaw Mountain on May 12, 1934, and successfully found several populations of Draba aprica.

With adequate material at hand, Dr. Fernald was able to determine that Nuttall's variety fastigiata was, indeed, the same as D. aprica, but since no other Arkansas stations had ever been located, Fernald was skeptical that Nuttall's plant had actually come from Arkansas.

On April 30, 1939, Julian A. Steyermark discovered D. aprica along the Black River in southeastern Missouri, at a location six miles north-

west of Piedmont, in Reynolds County. Steyermark sent material to Professor Fernald who verified the identification. Then, while studying earlier collections of his, Steyermark discovered that he had unknowingly found this plant nearly a decade earlier at the St. Francois Shut-ins south of Fredericktown, in Madison County.

On April 13, 1957, Reed C. Rollins and Kenton Chambers discovered D. aprica growing with D. brachycarpa north of Broken Bow, McCurtain County, Oklahoma.

During the summer of 1969, Dr. William D'Arcy of the Missouri Botanical Garden collected D. aprica east of the St. Francois River in Madison County, about two miles north of the area where Steyermark collected in 1930. In reporting his find, D'Arcy (1969) discusses running across an unidentified collection of a Draba made by E. J. Palmer on May 5, 1914, near Noel, McDonald County, Missouri. This collection of ten plants proved to be D. aprica.

Also in 1969, S. W. Leonard and D. Hobbs discovered this species at 40 Acre Rock in Lancaster County, South Carolina.

In 1972, William C. Taylor, a student at Southern Illinois University, discovered this species along Jonca Creek in Ste. Genevieve County. The contractor has observed and studied this colony for the life history account of D. aprica.

Arthur Christ found D. aprica in Madison County, about eight miles west-southwest of Fredericktown, along Cedar Bottom Creek, on April 28, 1972.

Paul Nelson, another student at Southern Illinois University, found this species in 1975 and in 1976 at Johnson Shut-ins State Park in Reynolds County.

Only one of the eleven stations known for this species occurs in the St. Louis District (in Ste. Genevieve County), but the three Madison County localities are within seven miles of the boundary. Although the contractor has failed to locate additional stations in the St. Louis District, he speculates that this mustard will be found at other localities in the region, particularly in the St. Francois Mountains.

Life History

Draba aprica is an annual. First notice of its basal leaves (in the Ste. Genevieve County population) has been around th first week in April, but the leaves doubtless could be found somewhat earlier during mild winters. The stem elongates rather rapidly, attaining its maximum height of 35 cm by late April.

The first stem leaves develop shortly after the stem initiates elongation. The stem leaves are smaller and narrower than the basal leaves. The lowest ones are relatively remote from each other, but the upper ones are more crowded. As many as seventeen stem leaves may be formed, but generally there are fewer. From the axil of the fourth, fifth, sixth, or seventh leaves on the stem (counting from the bottom), short branches may develop which eventually produce flowers.

Flower buds may be detected by mid-April, although anthesis, or the actual opening of the flowers, does not usually occur until the last week in April and the first two weeks in May. Each individual flower remains open for up to seven days, but after the third or fourth day, the young fruit can be detected. Within ten days following anthesis, the fruit has reached its length of 4-6 mm and has matured its usually six seeds. The seeds are shed readily and the fruits soon wither. By late August, the entire plants usually have begun to wither. They die back completely by mid-September. Rarely do the seeds germinate during the same growing season. Seed viability study reveals a germination of eighty-five per cent under greenhouse conditions.

Description

Annual. Stems up to 35 cm long, unbranched below, becoming short-branched from the middle and upper leaf axils, stellate-pubescent. Basal leaves obovate to oval, petiolate, thin, dentate, stellate-strigose, up to 2 cm long. Stem leaves up to 17 in number, remote below, becoming more crowded above, narrowly obovate to linear-lanceolate, sessile, entire or sparsely dentate, up to 2 cm long. Flowers borne in condensed clusters, perfect, on short, stellate-pubescent pedicels; sepals 4, narrowly oblong, up to 1 mm long, green; petals 4 (or rarely absent), spatulate, 2.5-3.0 mm long, white; stamens 6; ovary superior. Fruits (siliques) linear-ellipsoid, 4-6 mm long, minutely stellate-puberulent, with the minute slender style persistent. Seeds 6, oblong-oval, 1.0-1.5 mm long.

Taxonomy

Draba aprica is similar to D. brachycarpa by virtue of the presence of several stem leaves. In fact, it was originally described as a variety of D. brachycarpa. Although the two taxa are somewhat similar in appearance, they appear to me to be specifically distinct on the basis of the following characteristics possessed by D. aprica:

1. Larger and fewer seeds.
2. More elongate, densely pubescent fruits (siliques).
3. Shortened branches and condensed flowering clusters.
4. Pubescence of more intricately branched hairs.

Collections Known

Because of the extreme rarity of this species, all collections known to the contractor are listed below. All have been examined in conjunction with this study except for the Nuttall type.

Arkansas: Collected in 1819 by T. Nuttall.
Georgia: Kenesaw Mountain, near Marietta, May 9, 1901, C. B. Beadle.
Missouri: Noel, McDonald Co., May 5, 1914, E. J. Palmer 5500.
Missouri: St. Francis Shut-ins, south of Fredericktown, Madison Co., April 27, 1930, J. A. Steyermark 1750.
Georgia: Kenesaw Mountain, near Marietta, May 5, 1934, L. M. Perry & M.C. Myers 750.
Georgia: Kenesaw Mountain, near Marietta, May 12, 1934, L. M. Perry & M.C. Myers 751.
Missouri: Along Black River, between mouth of Cave Spring Hollow and Logslide Bluff, 6 miles northwest of Piedmont, Reynolds Co., April 30, 1939, J. A. Steyermark 22097.
Oklahoma: 3.7 miles north of Broken Bow, McCurtain Co., April 13, 1957, R. C. Rollins & K. Chambers 5762.
Missouri: East of the St. Francois River, Madison Co., 1969, W. D'Arcy 3257.
South Carolina: 40 Acre Rock, Lancaster County, April 12, 1969, S. W. Leonard & D. Hobbs 2351.
Missouri: Along Jonca Creek, Ste. Genevieve Co., May 13, 1972, W. C. Taylor 649.
Missouri: Madison Co.: about 8 miles WSW of Fredericktown, at base of south-facing slope in steep moist rocky soil along Cedar Bottom Creek, NW¼, sect. 31, T33N, R6E, April 28, 1972, A. Christ.
Missouri: Johnson's Shut-ins State Park, Reynolds Co., April 30, 1975, P. Nelson 907a; also April 11, 1976, P. Nelson 1125a.

Habitat

Draba aprica has been found on steep oak-pine slopes, low rocky woodlands, dry rocky ground, along streams, and open knolls sparsely covered with dwarfed oaks and pines. At every station known to the contractor, shortleaf pine (Pinus echinata) and one or more species of oaks have dominated the overstory.

Distribution and Status in the St. Louis District

Of the ten known stations for Draba aprica, six are in Missouri, with one of the Missouri localities being within the boundaries of the St. Louis District, U. S. Army Corps of Engineers. The station for this species along the Black River northwest of Piedmont in Reynolds County has already been destroyed by the impoundment of Clearwater Lake. The other localities are situated in the watershed of the Black River, the St. Francois River, and Jonca Creek so that any projects involving these areas must be looked at closely. The only serious

threat to Draba aprica would seem to be with impoundment of the adjacent rivers or creeks. The plant is so inconspicuous that over-collecting should be no problem.

Missouri Alumroot

(Heuchera missouriensis Rosendahl)

This is one of the rarest of all species in the bi-state region. It is known from only two locations along the St. Francis River, one in Madison County and one in Wayne County.

Although neither station is in the St. Louis District, they both occur within ten miles of the boundary and may very likely be found in the District. Therefore, Heuchera missouriensis is included in this study and is given a full treatment.

It is considered Endangered in the Federal list of 16 June 1976.

History and General Distribution

The discovery of this species was made on July 9, 1936, by Julian A. Steyermark from Hall's Bluff along the St. Francis River, about six miles south of Greenville, in Wayne County. Then, on November 15, 1936, Steyermark found a second locality for this species, this time along the St. Francis River east of Jewett, in Madison County.

Puzzled by the somewhat different characters of these plants, Steyermark sent his collections to Dr. C. O. Rosendahl at the University of Minnesota who was doing a thorough study of the genus Heuchera. In 1938, Rosendahl reported the plants to represent a hybrid between Heuchera puberula Mack. & Bush and Heuchera americana L. var. hirsuticaulis (Wheelock) Rosend., Butt., & Lak.

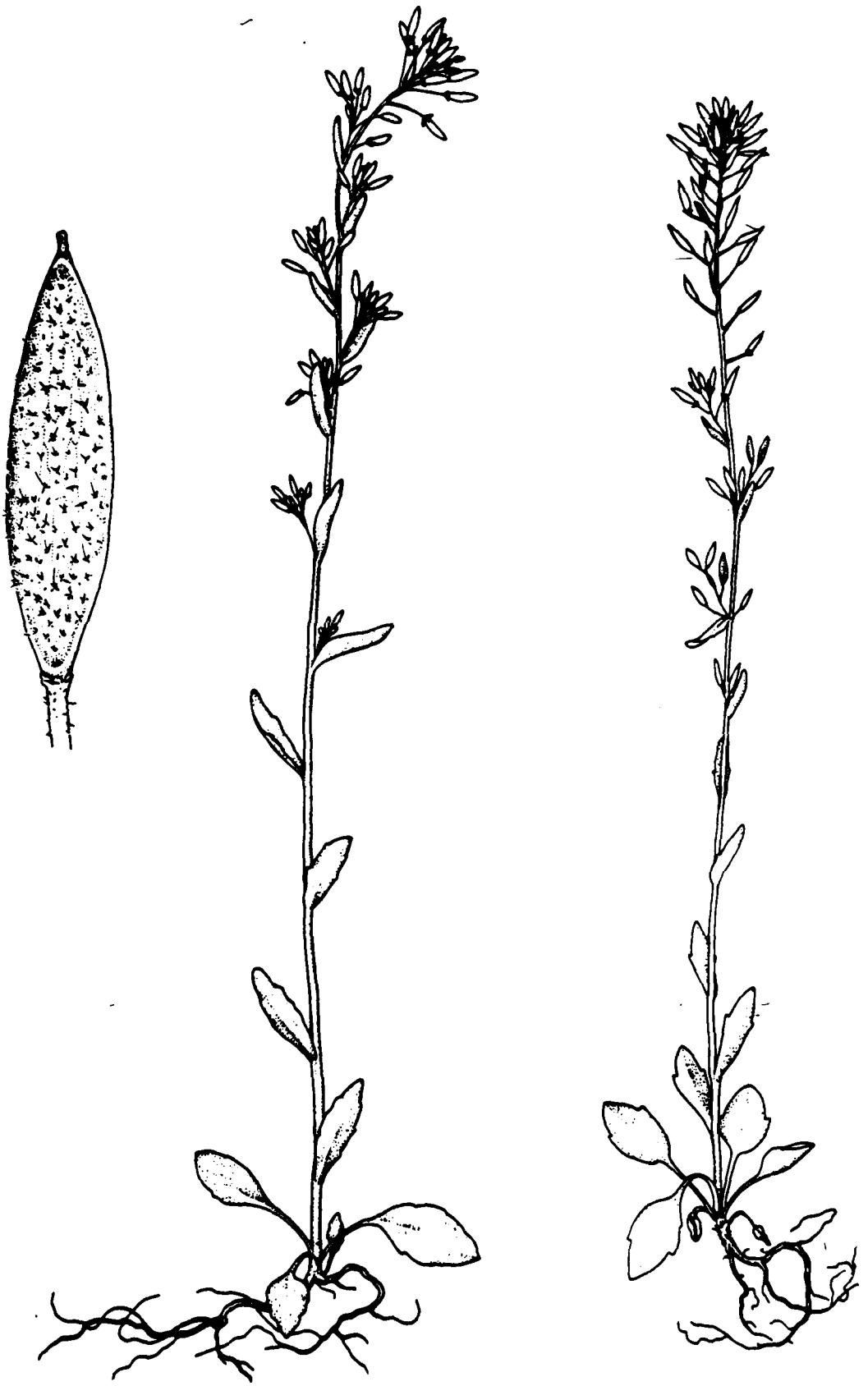
On September 1, 1938, Steyermark revisited the Hall's Bluff site and made further collections of this taxon which he again sent to Dr. Rosendahl.

Two years later, Rosendahl changed his mind and reported the collections to be Heuchera parviflora Bartl. var. rugelii (Shuttlw.) Rosend., Butt., & Lak.

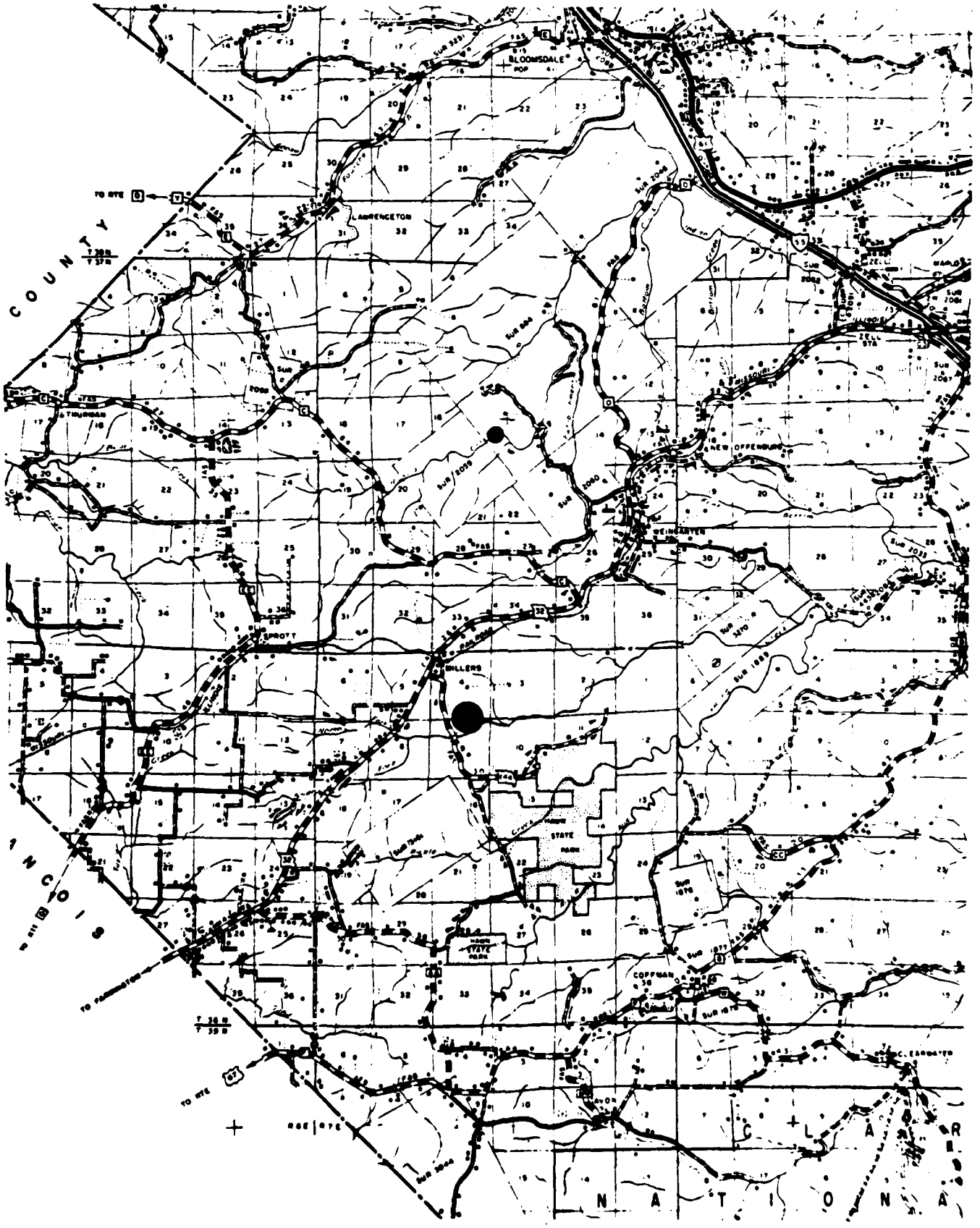
On October 21, 1948, Steyermark made a third collection from Hall's Bluff, which included flowers, fruits, seeds, leaves, and rootstocks. Upon thorough examination of this material, Rosendahl described Heuchera missouriensis as new to science in 1951.

During the course of this investigation, both the original stations for this species were located. Attempts to find Heuchera missouriensis in other seemingly similar situations along the St. Francis River have failed.

Whitlow Grass (Draba aprica). (Left), fruit; (Center, Right), habits.



Portion of Ste. Genevieve County, Missouri. Large dot shows locality of Draba aprica; small dot shows locality of Plantago cordata.



Life History

Heuchera missouriensis is a perennial with a few overwintering green leaves. By April 1, new leaves of the season begin to expand, reaching mature size in about 24 days. Additional new leaves continue to unfold through April.

Flowering production appears to be sporadic and irregular. Inflorescence axes can be detected in some plants by the second week in June, while in other specimens, initiation is delayed until later times. The latest inflorescence initiation observed was during the last week in September. Once the inflorescence axis initiates, it takes about three weeks before it reaches its maximum length. Flowers remain open for about five to seven days before the petals wither. Fruits develop, the earliest by July 30, and are subtended by the persistent, brown calyx. Each inflorescence usually produces new flowers until late October. Fresh flowers have even been observed in anthesis as late as November 15. Ripe seeds seem to be present between ten and fifteen days following anthesis. The seeds appear to require a winter dormancy before becoming viable. Germination under greenhouse conditions is very poor. Naturally occurring germination has not been observed. Many leaves wither and die during the autumn but persist at the base of the plant through the winter.

Description

Perennial from fibrous roots. Leaves all or nearly all basal, the blades up to 12 cm long and up to 14 cm broad, orbicular-reniform, usually 7- to 9-lobed, the lobes crenate-dentate, the teeth broadly obtuse, mucronate, the blades more or less villous above, densely villous below; leaf stalks densely pilose, with long, pale rusty or sordid, glandular hairs. Flowering stems to 36 cm tall, glandular-villous; panicles 10-18 cm long, narrow, many-flowered; pedicels to 5 mm long, recurved at maturity; flower small, glandular-hairy, in anthesis up to 4.5 mm long, the calyx reddish-brown; sepals ovate, obtuse, 1-2 mm long, about as broad; petals white, oblanceolate, up to 1.6 mm long, 0.6 mm broad, clawed at the base; stamens up to 3 mm long. Fruit turbinate, 2.4-3.0 mm long, the beak recurved; seeds black, 0.35-0.45 mm long, verrucose-striate.

Taxonomy

Because of the extreme rarity of this species, there is skepticism among some botanists that specific rank is not appropriate. There are several possible alternatives for Heuchera missouriensis. (1) It may be a distinct species; (2) it may be a variety of H. puberula with glandular flowers; (3) it may be a variety of H. americana with smaller white flowers and smaller fruits; (4) it may be an abnormal variation

to be included within H. puberula or H. americana; (5) it may be a hybrid between two species, perhaps H. puberula and H. americana.

It is the opinion of the contractor that characters of the flower and the seed justify specific status for this species.

Collections Known

Because of the rarity of this species, all known collections are listed below. All collections are from Missouri.

Wayne Co.: Hall's Bluff, along St. Francis River, 4 miles south of Kime, 6 miles southeast of Greenville, south of Davidson's Blue Spring, T 27N, R6E, sect. 5, July 9, 1936, J. A. Steyermark 11542.

Wayne Co.: Same location as above, September 1, 1938, J. A. Steyermark 6342 (holotype).

Madison Co.: Along St. Francis River, between mouth of Captain Creek and bridge over highway to Jewett, November 15, 1936, J. A. Steyermark 20980.

Wayne Co.: Same as above, October 21, 1948, J. A. Steyermark 66966.

Wayne Co.: Same as above, November 7, 1976, P. Nelson 667a.

Madison Co.: 1 mile downstream from mouth of Captain Creek, November 6, 1976, P. Nelson 666a.

Habitat

Heuchera missouriensis is found only in the crevices of limestone bluffs along or in the vicinity of the St. Francis River in Missouri.

At Hall's Bluff, the substrate is easily fractured, cherty limestone. Abundantly associated with this species is the smooth purple cliff-brake (Pellaea glabella). Several specimens of wild hydrangea (Hydrangea arborescens) are nearby, but few other understory plants are present. The bluffs are much exposed to strong north winds. Where the bluffs extend to the water's edge, H. missouriensis is absent. Most of the bluffs where this plant occurs are very dry. There is no seepage evident in the bluffs.

At the Captain Creek station, there are some plants colonial on the ground at the base of the bluffs, with many other plants extending up ledges to at least a height of thirty feet. Some plants are in cave entrances. The bluffs at this station are north-facing, with many pillars and small caves. There is an extensive talus slope at the base of the approximately one hundred foot tall bluffs. Large trees of sweet gum (Liquidambar styraciflua), sugar maple (Acer saccharum), basswood (Tilia americana), slippery elm (Ulmus rubra), and red oak (Quercus rubra) provide considerable shade for H. missouriensis. Associated

herbaceous plants at this station are smooth purple cliff-brake (Pellaea glabella), cup-plant (Polymnia canadensis), bulblet bladder fern (Cystopteris bulbifera), and species of shield fern (Dryopteris spp.).

Distribution and Status in the St. Louis District

(Both stations of this species are within seven miles of the boundaries of the St. Louis District and are included in this study.)

Only two localities in the World are known for this species, although a few other seemingly suitable habitats occur along the St. Francis River from the mouth of Captain Creek to Lake Wappapello.

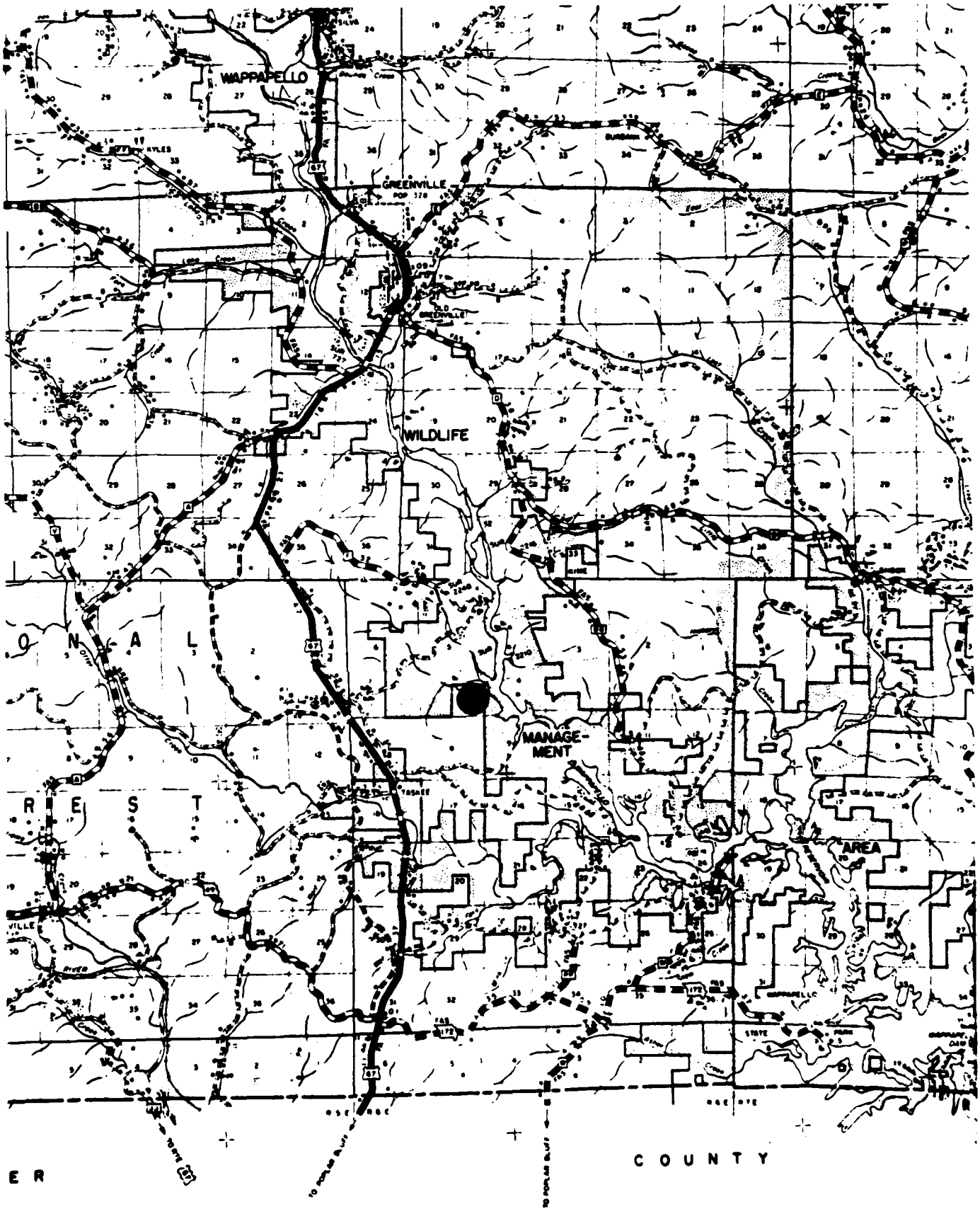
At the Hall's Bluff station where there are about 300 plants, the water of Lake Wappapello lies at an elevation safely below the existing plants of Heuchera missouriensis. It is possible that specimens of this species were exterminated by the impoundment. Removal of the forest during the construction of the lake opened the canopy and has permitted increased exposure of the plants. Whether the number of specimens has decreased because of this increased exposure is not known, but a sizeable population still exists on the bluff. Because of the general inaccessibility of Hall's Bluff today, the remaining plants are in little danger of exploitation by man.

At the Madison County station, the number of specimens is less than at Hall's Bluff. Because they are on privately owned, nearly inaccessible hinterland, they, too, are in little danger from normal activities of man. Impoundment of the water adjacent to the bluffs would eradicate those plants at the lower elevations of this station.

Field personnel should be on the alert for this species within the St. Louis District.

Missouri Alumroot (Heuchera missouriensis). (Upper left), flower; (Center), habit.

Portion of Wayne County, Missouri, showing locality of Heuchera missouriensis.



Small Whorled Pogonia

(Isotria medeoloides (Pursh) Rafinesque)

This orchid, sometimes claimed to be the rarest orchid in eastern North America, has been found about twenty times, scattered in the northeastern states. It is considered Endangered in the Federal list of 16 June 1976.

History and General Distribution

Perhaps the first collection of this elusive little orchid came nearly two centuries ago when John Clayton discovered it is Virginia. Then, little by little, it began turning up in other areas--Massachusetts, New York, Vermont, New Hampshire, Maine, Connecticut, New Jersey, Pennsylvania, Rhode Island, North Carolina. In 1897, Colton Russell found this species near Glen Allen, Bollinger County, Missouri, hundreds of miles from its nearest known station. In recent years, Isotria medeoloides has been discovered in Michigan. In the autumn of 1973, a small colony was found in Randolph County, Illinois. Both the Bollinger County, Missouri, station and the Randolph County, Illinois, station are within the St. Louis District.

Life History

(Dates reported here are based partly on a study by Mr. Mike Homoya from the Randolph County population.)

This dwarf plant emerges by May 5 and is in flower by May 13, nearly one month before the stem has attained its maximum length and the leaves their maximum size.

The length of time necessary for the capsule to mature is about one month after the flowers open.

The plants wither and are generally gone by late September or early October.

During 1976, the Randolph County population did not form mature seeds.

Description

Perennial herb. Stems erect, rarely exceeding 15 cm in height. Leaves in a single whorl at the top of the stem and beneath the flowers, 4 to 5 in number, elliptic, up to 5 (-6) cm long, glabrous. Flowers 1 or 2 at the tip of the stem, pedicellate, the pedicels about 1 cm long. Sepals 3, arching, greenish-yellow, up to 2.5 cm long; petals 3,

greenish-yellow, up to 1.5 cm long, the lip 3-lobed. Capsule up to 2.5 cm long, the stalk about 1 cm long.

Taxonomy

This species and Isotria verticillata are the only members of this genus in the northeastern United States. Isotria medeoloides is the smaller of the two and has greenish rather than purplish flowers.

Habitat

At its Randolph County station, Isotria medeoloides grows on a dry, rocky, north-facing slope above a sandstone bluff.

Distribution and Status in the St. Louis District

Only a single station is known in each of Missouri and Illinois, and both are in the St. Louis District.

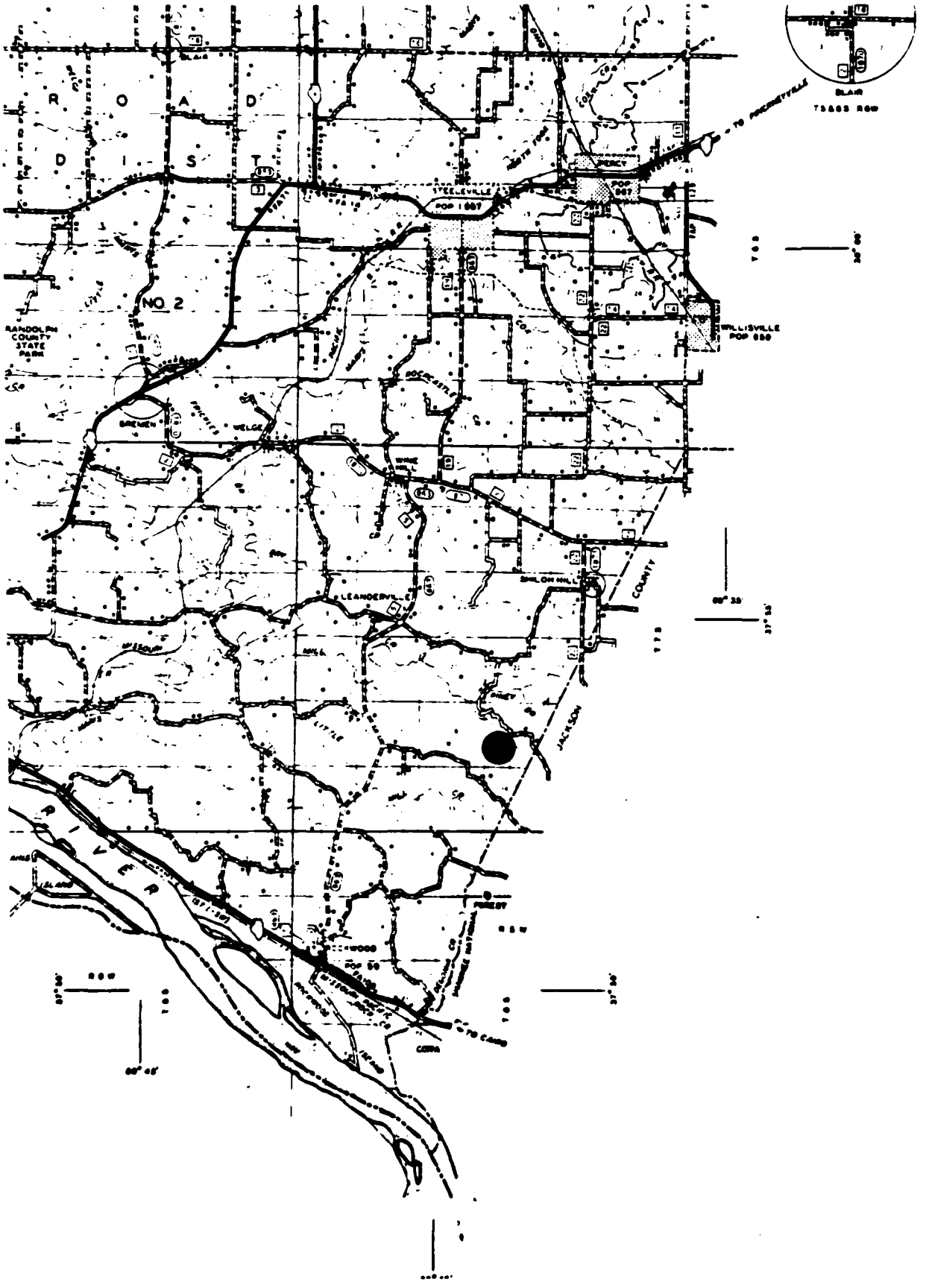
The Missouri locality is near Glen Allen, in Bollinger County, where it was found in 1897. Steyermark has searched several times in an effort to relocate this station, but he has been unsuccessful.

The Illinois station was discovered in 1973. During 1976, three specimens made up this colony.

Isotria medeoloides appears to be a very delicate species, managing to survive only with difficulty. I would speculate that in order for the Illinois station to remain extant, absolutely no disturbance of the habitat where it occurs must take place.

Small Whorled Pogonia (Isotria medeoloides).

Portion of Randolph County, Illinois, showing locality of Isotria medeoloides.



Heart-leaved Plantain

(Plantago cordata Lam.)

This species is a large-leaved, native member of the plantain family. Although this species was found in several localities prior to 1935, it seemingly has become scarce in the last forty years. This species is considered Endangered in the Federal list of 16 June 1976. There is a proposal to delete this species from the Federal list because of its supposed abundance in Missouri.

History and General Distribution

Jean Baptiste Pierre Antoine de Monet de Lamarck described this species in 1791 based on plants grown from Canadian seed. From late in the eighteenth century until up to 1935, this species had been collected many times from New York to Minnesota south to Louisiana to Alabama, as well as in Canada.

The first Missouri collection was made in April, 1833, by George Engelmann west of St. Louis. In all, Plantago cordata has been found in 24 Missouri counties, 15 of which are entirely or partly in the St. Louis District. Several of these stations apparently are no longer in existence. Extant populations are still known in the St. Louis District from Dent, Jefferson, Ste. Genevieve, Warren, and Washington counties.

In Illinois, the first collection of Plantago cordata was made in 1860 from Hancock County. It has now been found in 17 counties, four of them in the St. Louis District. Of these four, apparently only the station in Jackson County is extant. Most Illinois collections were made prior to 1903.

Tessene (1968) has studied this species in depth and noticed that most collections throughout the range of P. cordata were made prior to 1935. In his study, Tessene reports that he has been able to verify only eight localities for this species. These are:

Lambton County, Ontario
Columbia County, New York (2 localities)
Davidson County, North Carolina
Will County, Illinois
Jackson County, Illinois
Madison County, Missouri

In the preparation of this report, additional extant populations of this species have been located in Pope and Saline counties, Illinois, and in Reynolds County, Missouri. Previously known stations in Jefferson, Ste. Genevieve, Warren, and Washington counties, Missouri, have been relocated.

Life History

Plantago cordata is a perennial which overwinters in a green condition. The winter rosette leaves are narrower than the spring and summer leaves. They average up to 3 cm across and taper to the base, rather than being heart-shaped. The spring leaves emerge between March 3 and 16. By late April, they have attained their maximum size.

Flowering spikes are initiated in late autumn. During the winter, these spikes are protected by the sheathing petioles of the overwintering leaves. As many as six spikes may be produced in each rosette. The flowering spikes become evident between March 21 and April 2. Within seven days, the flowering spike elongates to as much as 30 cm. The flowers mature as the spike lengthens. The lowermost flowers are the first to mature. Initially, two stigmas emerge from each flower. In about four days, the stamens finally emerge.

About fourteen days after the spike has begun to elongate, it has reached a length up to 60 cm and bears as many as 130 flowers.

Mature fruits develop from the flowers by about May 15. As the capsules mature, the stalk of the inflorescence becomes firm, tough, and hollow. The seeds are expelled with the fleshy placenta still attached. These placentae serve as a buoy if the seed lands in water. The seeds will germinate in 6-14 days, although they will not germinate under water. The seeds will float for about three weeks before they become inviable.

Plants of this species flower during the second year.

Description

Herbaceous perennial with a fleshy, underground rootstock. Leaves in a basal rosette, dark green, the spring and summer leaves broadly ovate, subacute at the apex, heart-shaped at the base, up to 20 cm long, up to 15 cm broad, glabrous, sometimes wavy edged, the winter leaves narrow, up to 3 cm broad, tapering to the base. Flowering stalk up to 60 cm long, with as many as 130 flowers; flowers perfect, rarely overlapping; sepals 4, up to 4 mm long; petals 4, membranous, 2-3 mm long, persistent on the capsule; stamens usually 4. Fruit a capsule, more or less rounded, up to 11 mm long, dehiscing around the middle; seeds 2, up to 4 mm long.

Taxonomy

Plantago cordata is unquestionably distinct from all other species of Plantago by its fleshy roots and hollow stems. It has no near relations among the other species in the eastern United States.

Habitat

This species is found in gravel bottom streams and on moist wooded banks along streams. Trees in the overstory are frequently box elder (Acer negundo), red maple (Acer rubrum), sugar maple (Acer saccharum), pignut hickory (Carya glabra), and shagbark hickory (Carya ovata).

Distribution and Status in the St. Louis District

Although this species has been found in twenty-five counties in Missouri and eighteen in Illinois, only nine of the localities are within the boundaries of the St. Louis District. Of these, six of the stations are still extant. They are as follows:

Dent County: Along north fork of Meramec River, between Stone Hill and Indian Trail State Park, T34N, R4W, Section 11.
Jefferson County: Cliffsdale Hollow, southeast of Selma.
Ste. Genevieve County: Along Hickory Creek, northwest of Weingarten.
Warren County: Toque Creek, 6½ miles northeast of Marthasville.
Washington County: Sugar Camp Hollow, east of Anthonies Mill.

In Illinois, there are records of this species from eighteen counties, four of them in the St. Louis District. Of these four, only a station in Jackson County is extant.

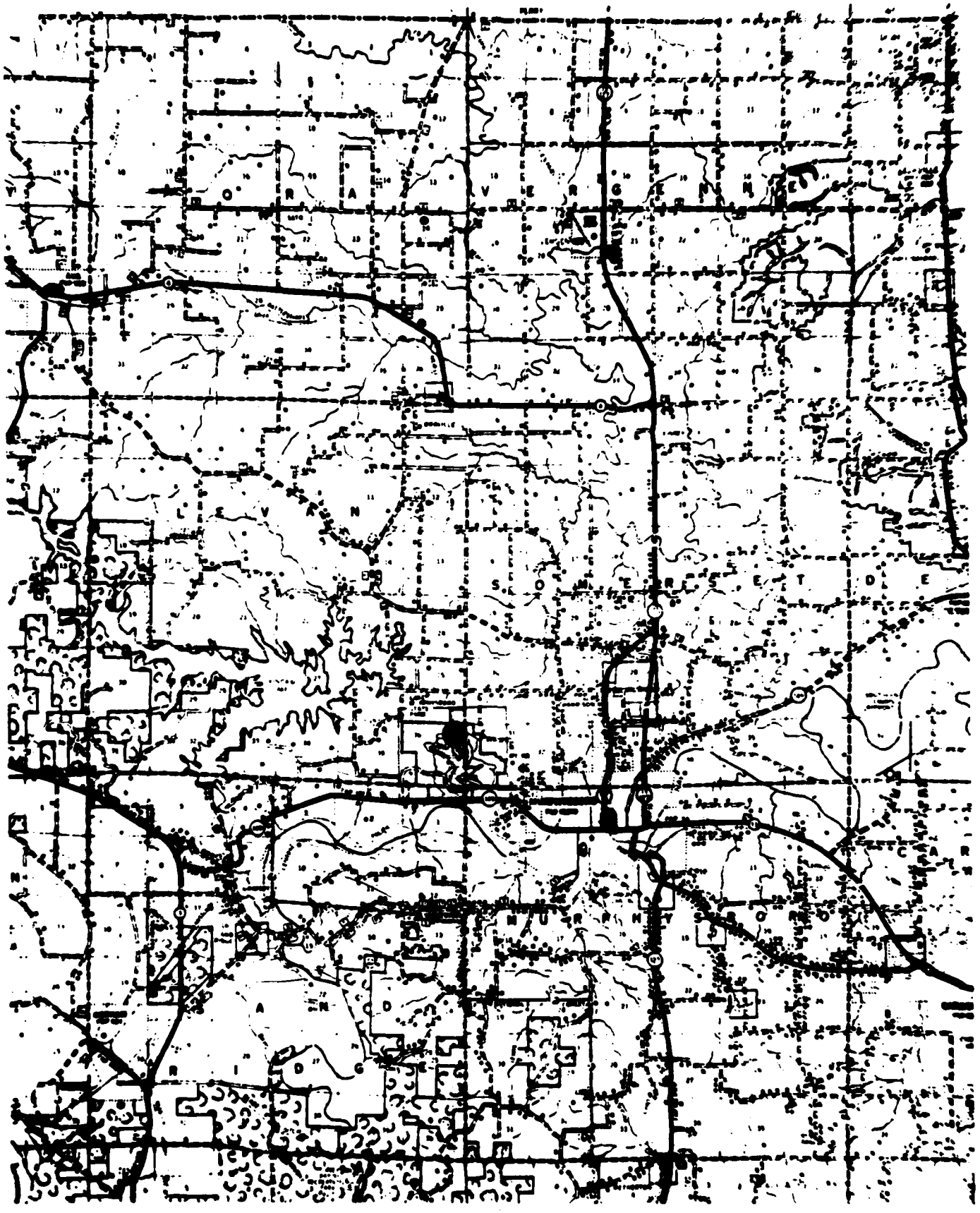
Jackson County: Lake Murphysboro State Park.

There is no doubt that this species is becoming very uncommon. Tessene (1968) has summed up the possible reasons for its decline as (1) lack of morphological variability, (2) early blooming date, short-lived seeds, and lack of ecological plasticity.

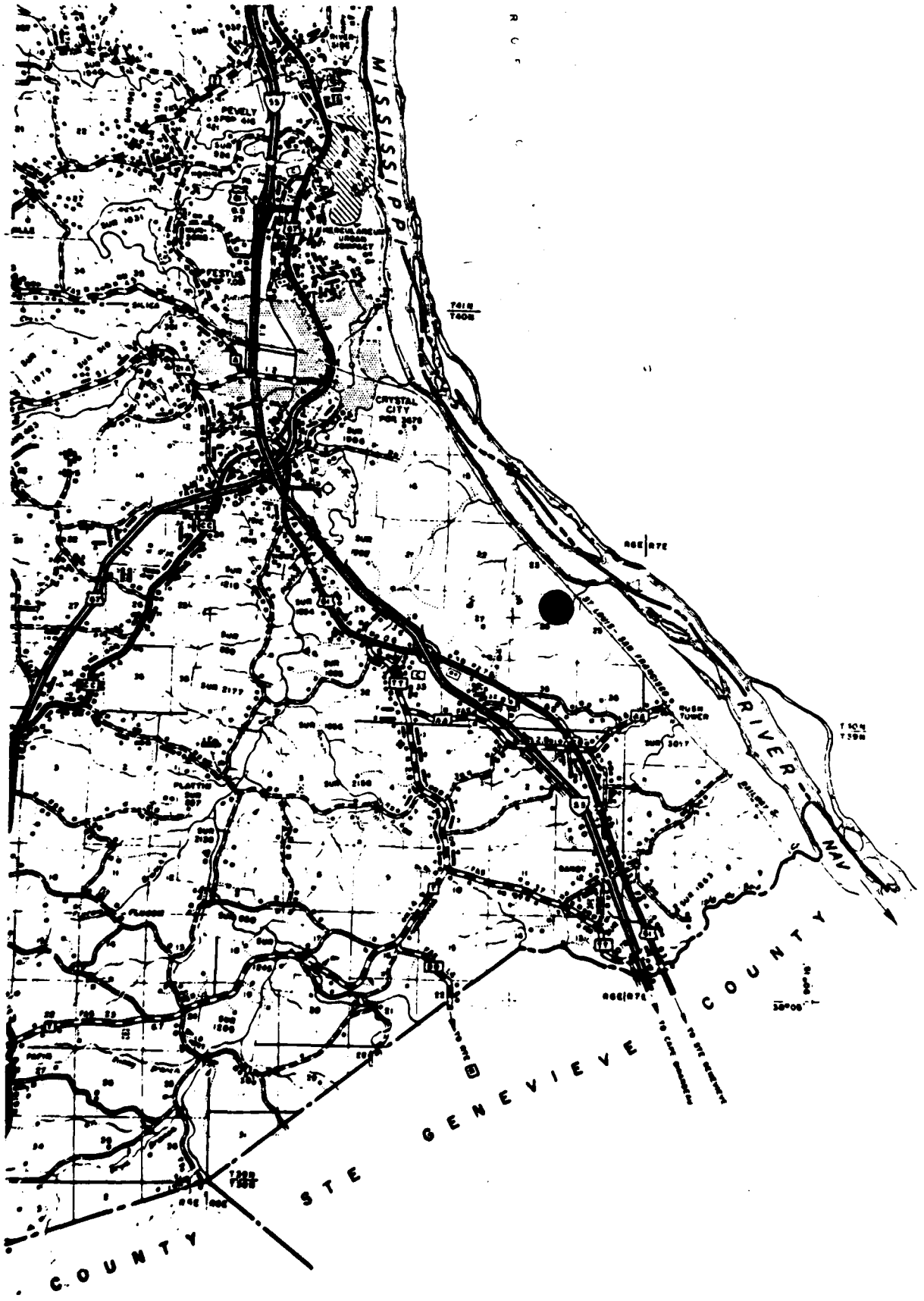
Protection should be given this species at all known localities. Since it always occurs in or adjacent to streams, any rise in the water level would cause its extermination.

Heart-leaved Plantain (Plantago cordata). (Left), habit; (Upper right), flower.

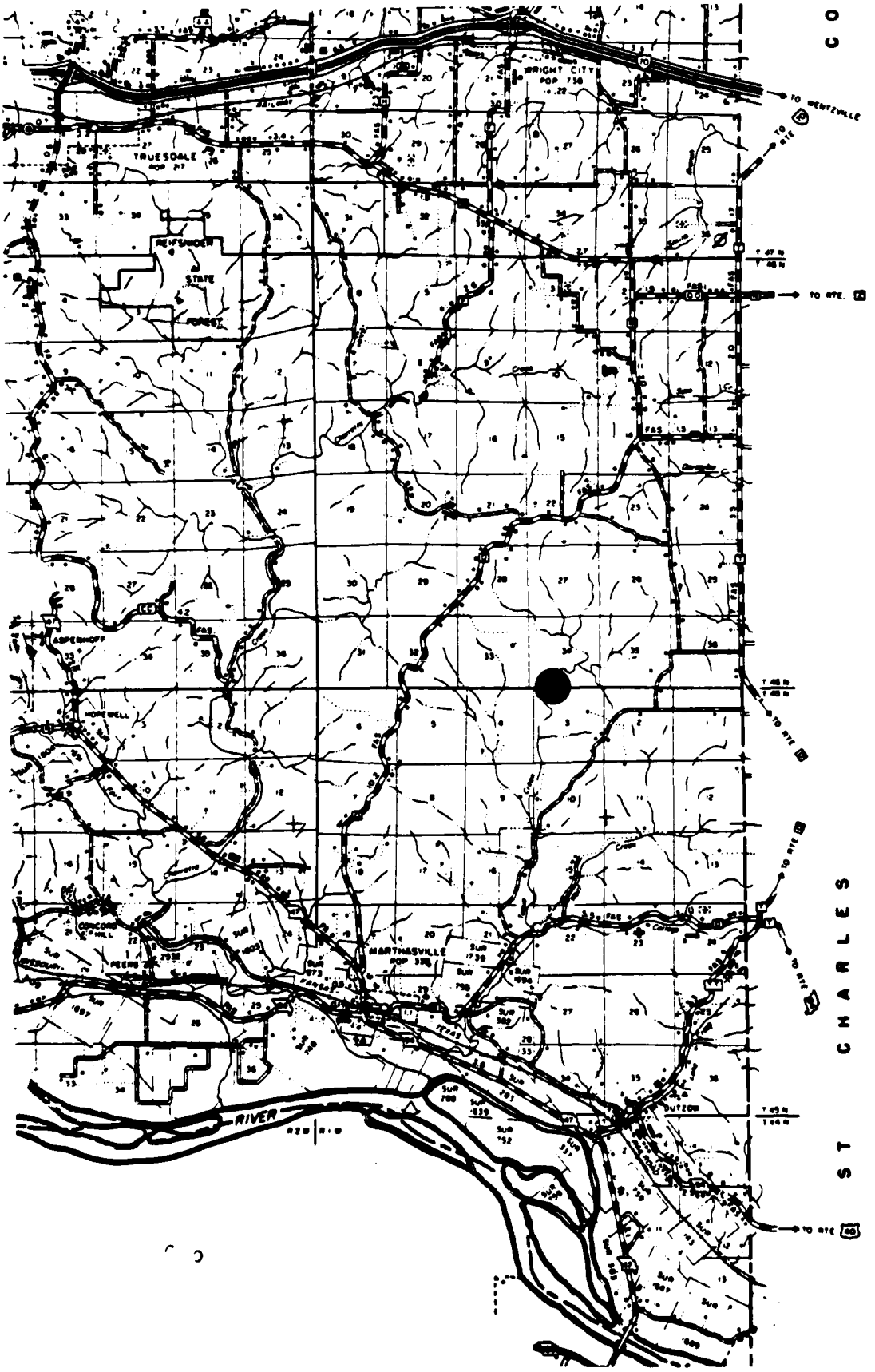
Portion of Jackson County, Illinois, showing locality of *Plantago cordata*.



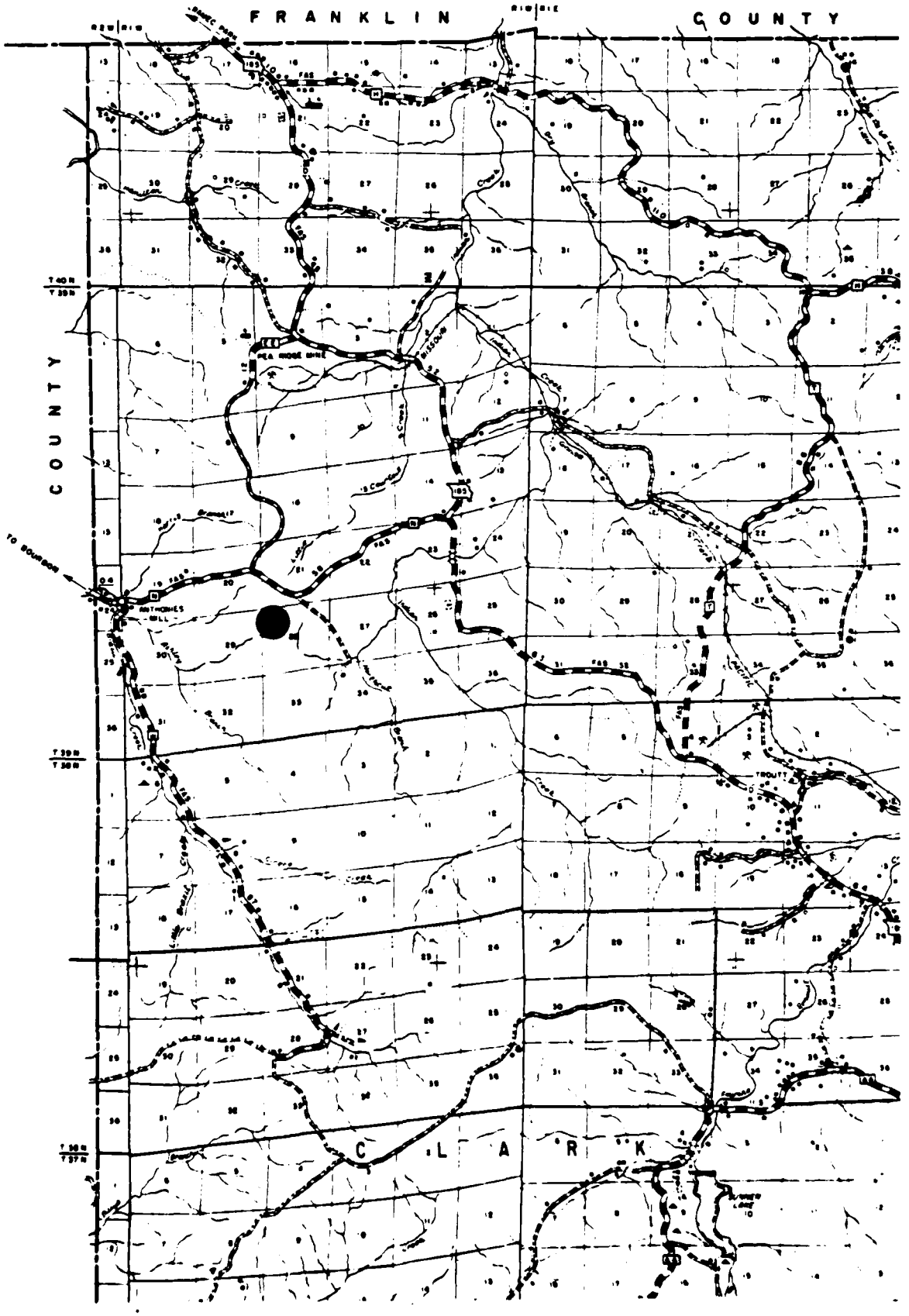
Portion of Jefferson County, Missouri, showing locality of *Plantago cordata*.



Portion of Warren County, Missouri, showing locality of Plantago cordata.



Portion of Washington County, Missouri, showing locality of Plantago cordata.



Other Endangered Species in Illinois-Missouri

In addition to the six endangered species known from the St. Louis District, U. S. Army Corps of Engineers, plus Heuchera missouriensis, eight other species are known from Illinois and/or Missouri which are on the 16 June 1976 list. Each of these is briefly discussed below and accompanied by a map showing its distribution in the bi-state area.

Calamagrostis insperata Swallen. Reed Bent Grass. This very rare grass is known in the bi-state area only from two locations in the southern part of the Missouri Ozarks in Douglas and Ozark counties. The only other locality for this grass in the World is in Ohio. The habitat for this species is rocky wooded ravines and open grassy rocky slopes of bluffs.

Castanea ozarkensis Ashe. Ozark Chinquapin. This tree may obtain a height of sixty-five feet. It occurs in ravines and on acidic ridges usually composed of chert or flint. In Missouri, this species has been found only in the southern and southwestern counties of the state. It is known from Barry, Howell, McDonald, Newton, and Stone counties. It also occurs in Arkansas and Oklahoma.

Geocarpon minimum Mackenzie. This dwarf species is a member of the pink family. It occurs on upland sandstone glades in moist depressions. It is limited to the unglaciated prairie section of southwestern Missouri and southeastern Arkansas. It has been found in the Missouri counties of Dade, Greene, Jasper, Polk, and St. Clair.

Iliamna remota Greene. Kankakee Mallow. This handsome, rose-flowered member of the mallow family occurs naturally only on Langham Island in the Kankakee River in Kankakee County, Illinois. An adventive station is known in northwestern Indiana. There is a very similar plant which occurs on Peters Mountain in Virginia. Some botanists consider it identical with I. remota, some call it a distinct species (I. corei Sherff), and some call it a variety (I. remota Greene var. corei (Sherff) Sherff).

Lespedeza leptostachya Engelm. Prairie Bush Clover. This prairie species is restricted to northern Illinois, southern Wisconsin, eastern Minnesota, and northern Iowa. In Illinois, it is known from DuPage, Winnebago, Cook, and McHenry counties.

Lesquerella filiformis Rollins. Bladderpod. This is a handsome, yellow-flowered member of the mustard family. It is known in the World only from four counties in extreme southwestern Missouri. Those coun-

ties, all in the unglaciated prairie section of Missouri, are Dade, Greene, Jasper, and Lawrence. It occurs on limestone glades and in rocky open woods.

Petalostemum foliosum Gray. Leafy Prairie Clover. This showy legume was originally known from northern Illinois and Tennessee where it occurred on rocky hills, in glades, and along rivers. A few years ago it was suspected of being extinct. Very recently, it has been found again in both states. In Illinois, it is known to grow at two localities in Will County.

Thismia americana N. E. Pfeiffer. This colorless, minute member of the tropical family Burmanniaceae was found, remarkably enough, near Lake Calumet in Chicago, Cook County, Illinois, by Norma E. Pfeiffer in August, 1912. Since 1914, it has never been seen again, despite repeated efforts to relocate the original site. It is probably extinct.

Other Species Proposed for Inclusion

After consulting several botanists in the bi-state area concerning other species which might qualify for the Federal list, the contractor has compiled the following list of three species. A discussion of each follows, which includes a brief historical sketch, current distribution and ecology, and a brief description.

False Aster

(Boltonia decurrens (Torr. & Gray) Wood)

This species was listed in the Smithsonian Report as a threatened species, but was not included in the Federal list of 16 June 1976.

Nonetheless, this plant has a very restricted range. It occurs only in eastern Missouri and western Illinois where it grows in alluvial bottomlands. It was originally found along the Illinois River, and it is known from Mason, Fulton, Tazewell, Peoria, Woodford, and LaSalle counties, all along the Illinois River. In the St. Louis District, it has been found in Lincoln, St. Charles, and St. Louis counties, Missouri, and in St. Clair County, Illinois.

This wetland species, because of its low habitat, is subjected to the vagaries of the adjacent waterways. Any threat to these waterways could prove damaging to this species.

This is a coarse perennial growing to a height of about 1.5 meters. The stems are pale green and smooth. The leaves range from oblong to lanceolate and bear no teeth. The base of each leaf is extended as a wing along the stem. The inflorescence is a large paniculate corymb, bearing numerous aster-like heads. Each head is composed of many linear, usually white rays surrounding a central disk. The disk is about 1 cm across. The base of each head is surrounded by many bracts which are up to 2 mm across. It flowers from late July to early October.

I would recommend that this species be placed on the Federal list of threatened species because of its very restricted range and its vulnerable wetland habitat.

Sedge

(Carex socialis Mohlenbr. & Schwegm.)

Carex socialis is a species described in 1969 from southern Illinois. It appears to have a range restricted to the Mississippi and Ohio River valleys, where it is known from western Kentucky, southern Illinois, and southeastern Missouri. The Jackson and Union county stations in Illinois are in the St. Louis District. More intensive collecting may widen the distribution of this species.

This is a wetland species, occupying moist woodlands, swamps, and sloughs.

Carex socialis is a perennial sedge with slender rhizomes. Its very slender perigynia further distinguish it from its nearest relatives, Carex rosea and C. convoluta.

Because of its restricted range and its wetland habitat, I recommend that this species be included in the Federal list of threatened species.

Prickly Groundberry

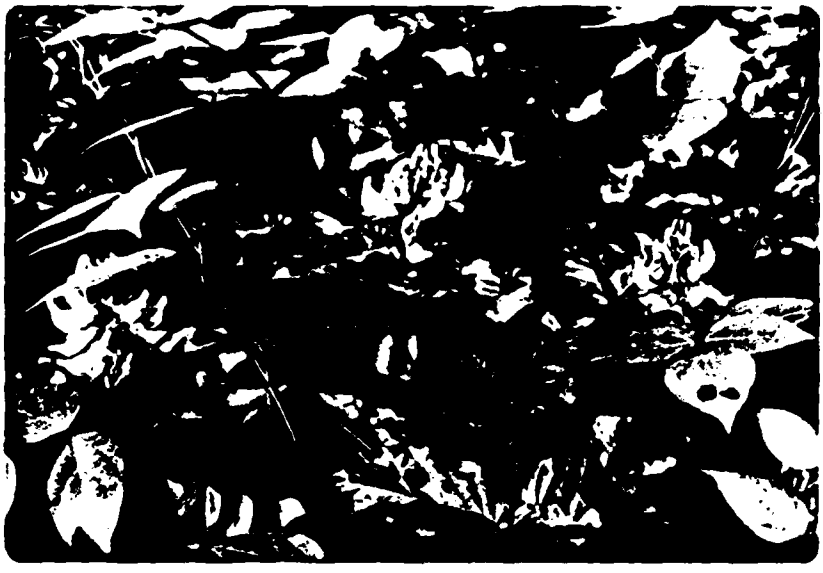
(Rubus missouricus Bailey)

Although I am recommending threatened status for this Missouri endemic, it may already be extinct since it has not been collected since June 7, 1932. Since species of Rubus are frequently overlooked by collectors, I believe there is a good chance that this species may be refound.

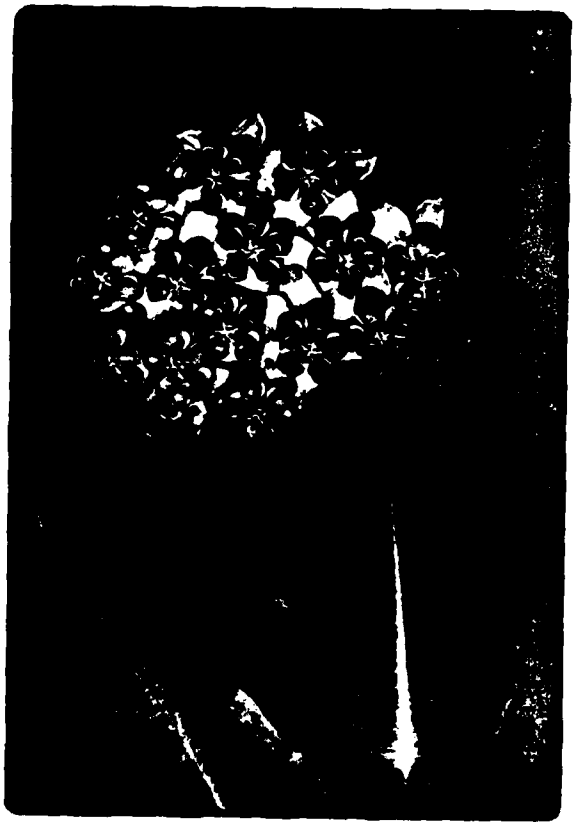
Benjamin Franklin Bush made several collections of this species from prairies near Lake City in Jackson County, Missouri. It had been found earlier, although not recognized as a new species, by E. J. Palmer near Galena in Stone County and by Reverend Davis near Silex in Lincoln County. This latter station is in the St. Louis District.

The new canes (primocanes) of this species arch to form a dome. Each stem is about 5 mm in diameter and bears only slightly curved prickles up to 5 mm long. The leaves of these primocanes bear five leaflets which taper to acuminate tips. The inflorescences are broader than long and bear ten or more flowers. The calyx is essentially glandless.

Color Photographs of Selected Species

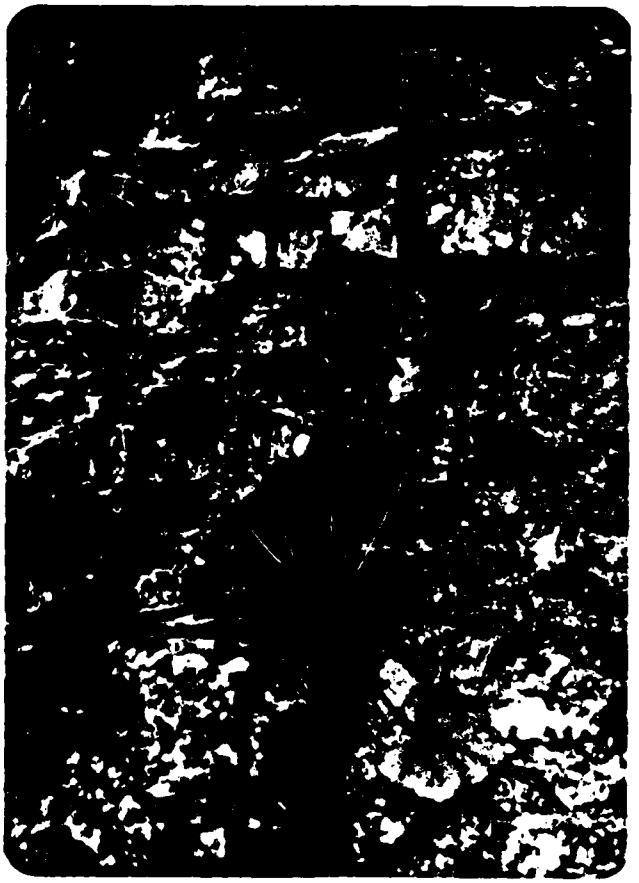


Apios priceana



Asclepias meadii

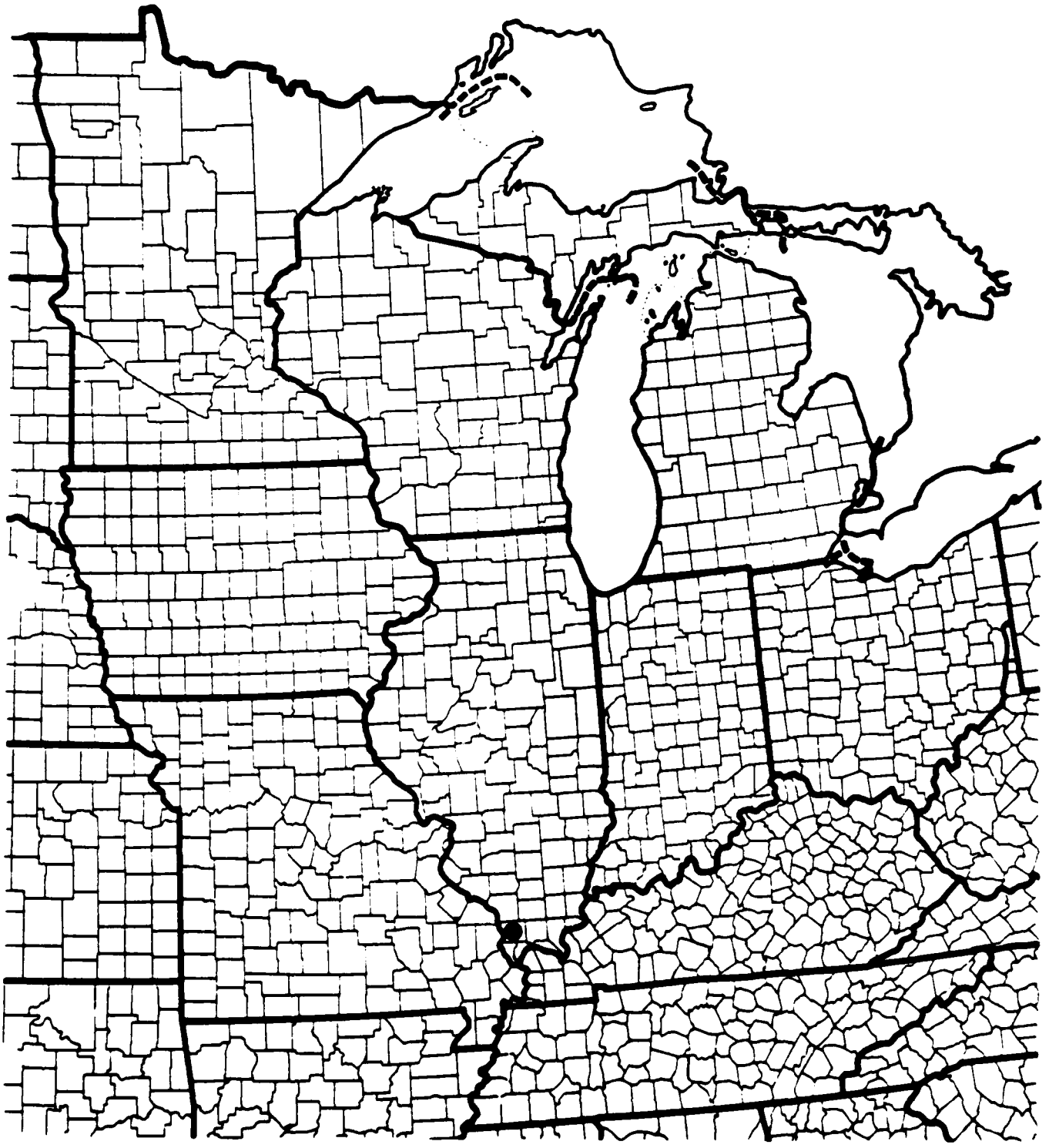
Plantago cordata



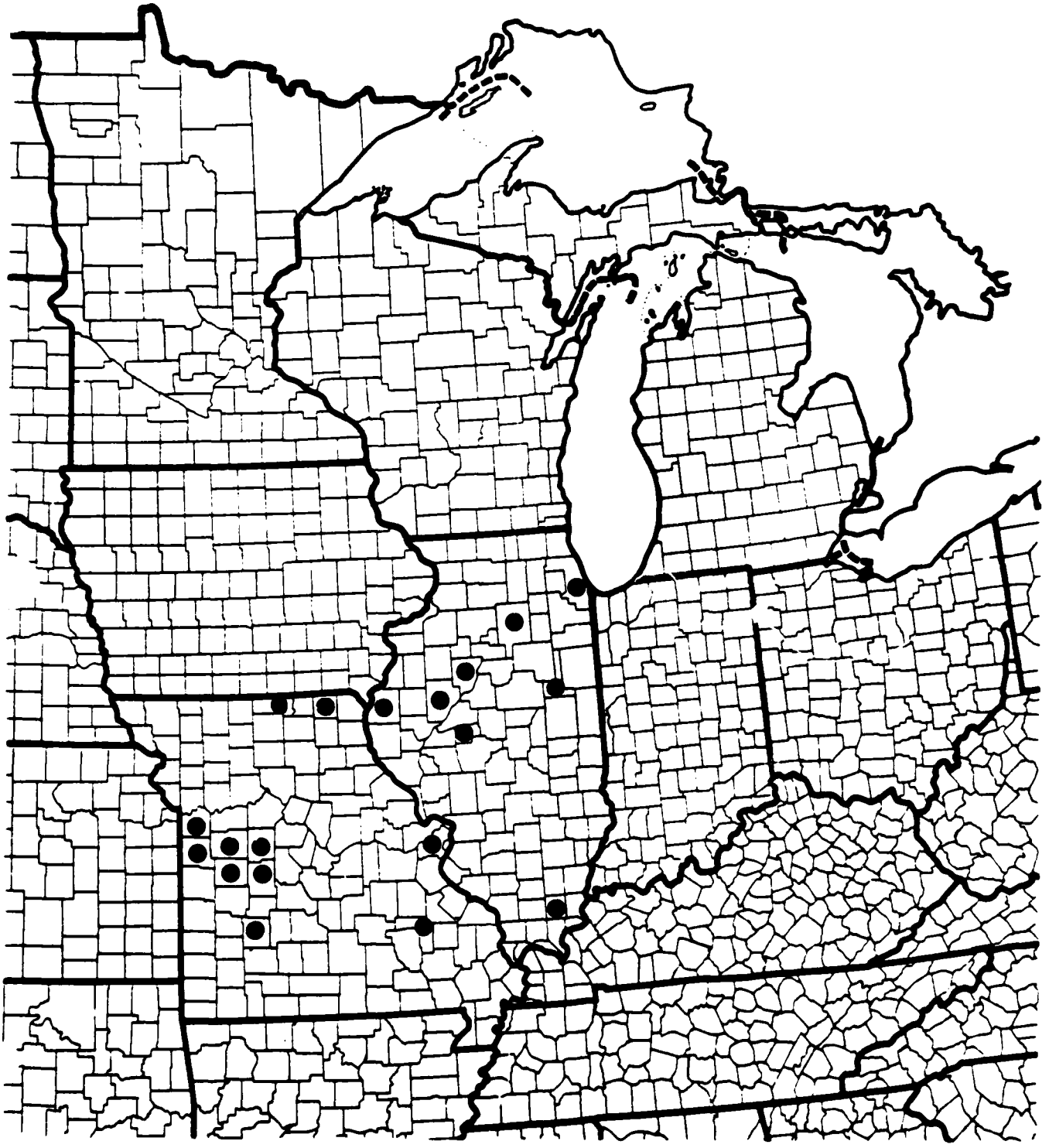
Heuchera missouriensis

Bi-state distribution of the 15 Federally listed threatened species
which occur in Illinois and/or Missouri

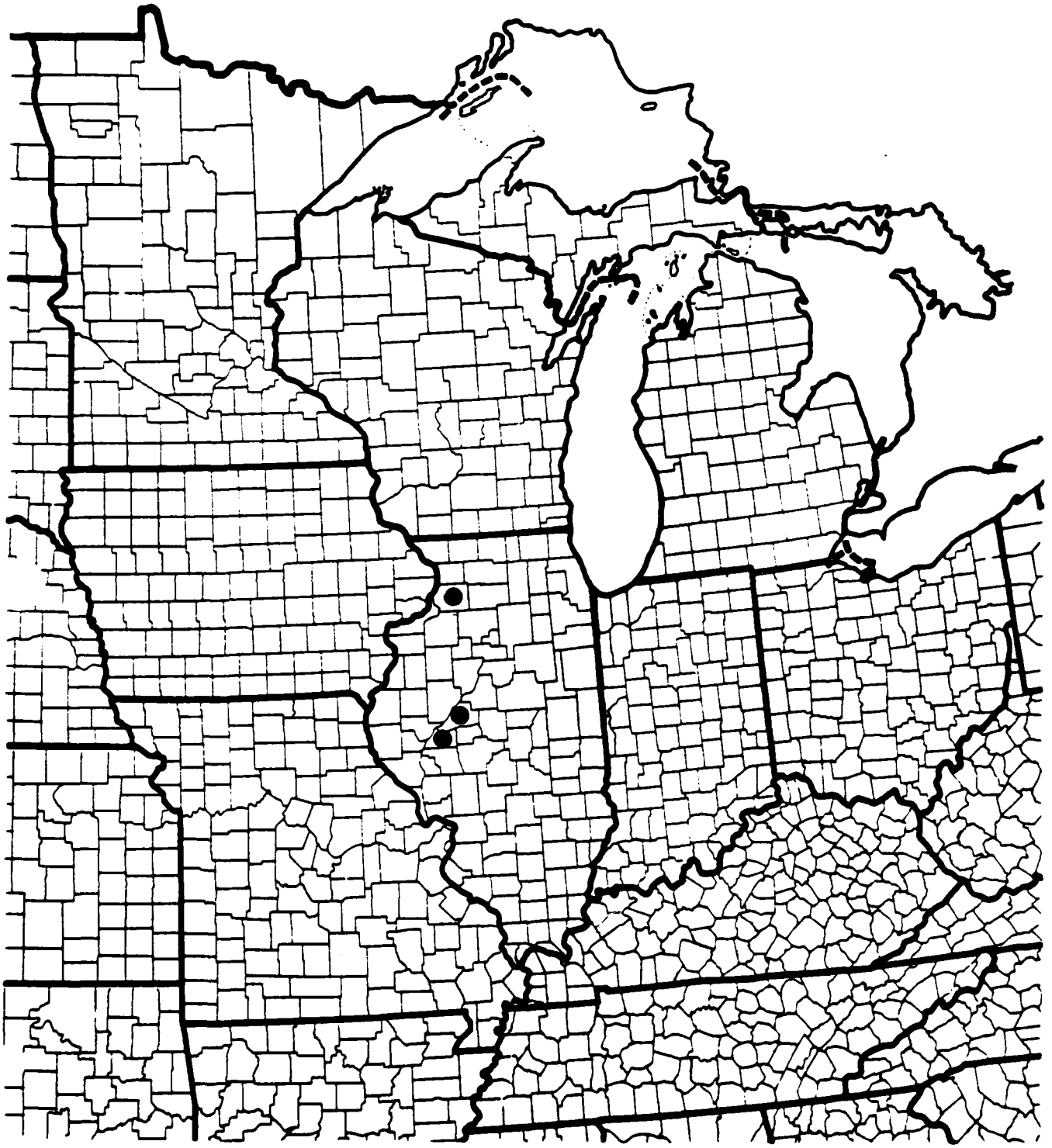
Distribution of Apios priceana in the bi-state area



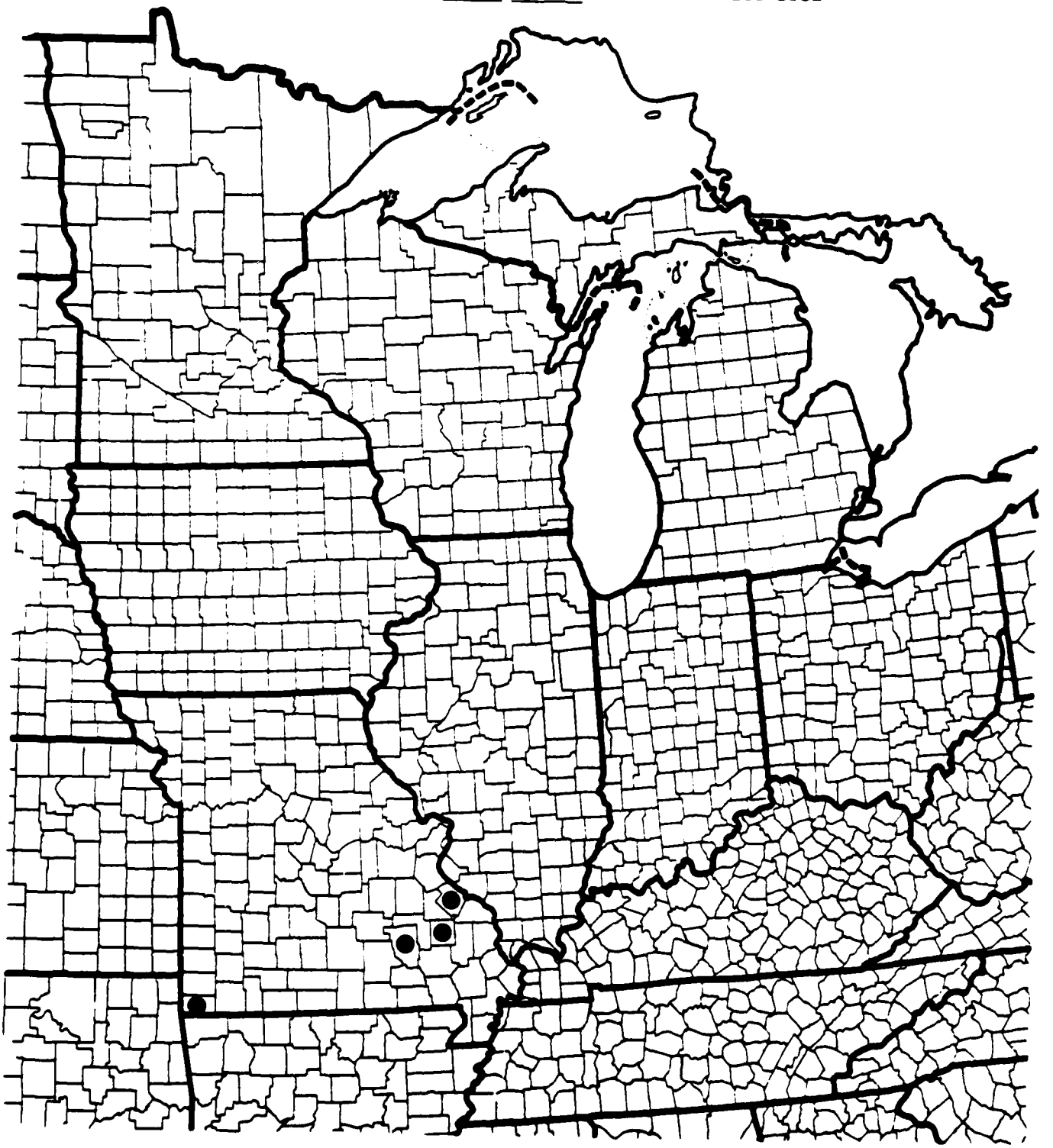
Distribution of Asclepias meadii in the bi-state area



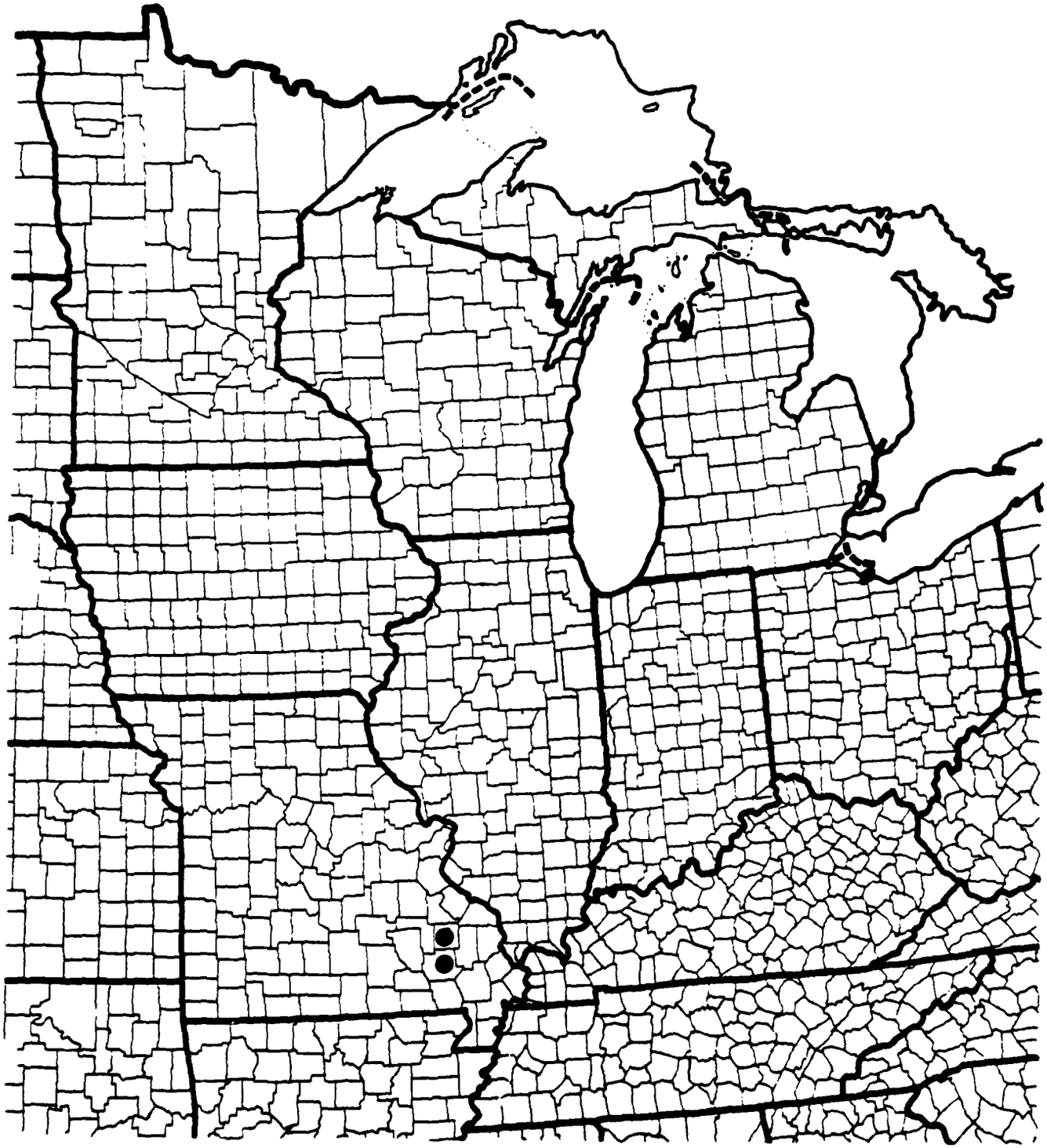
Distribution of Cyperus grayioides in the bi-state area



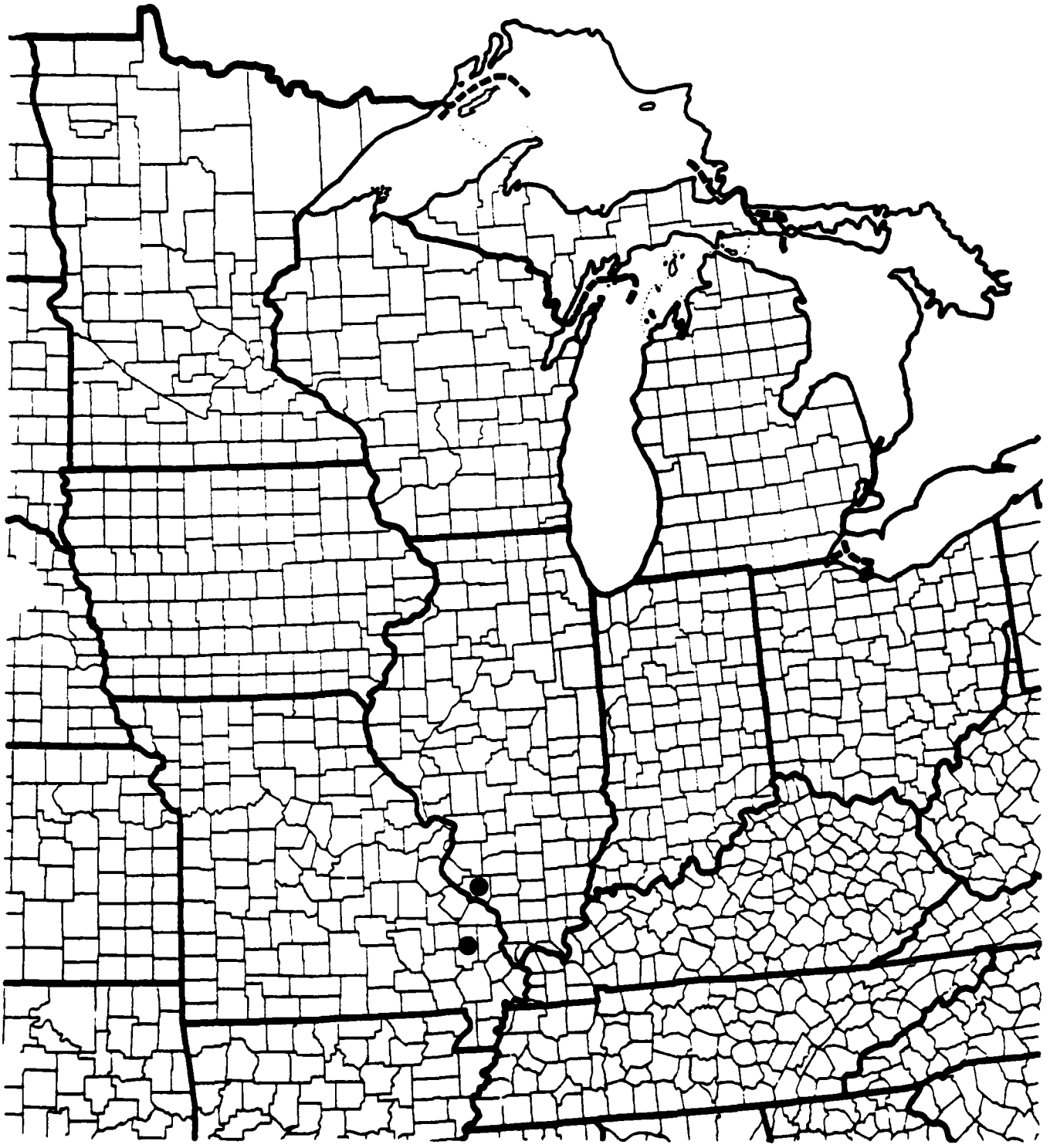
Distribution of Draba aprica in the bi-state area



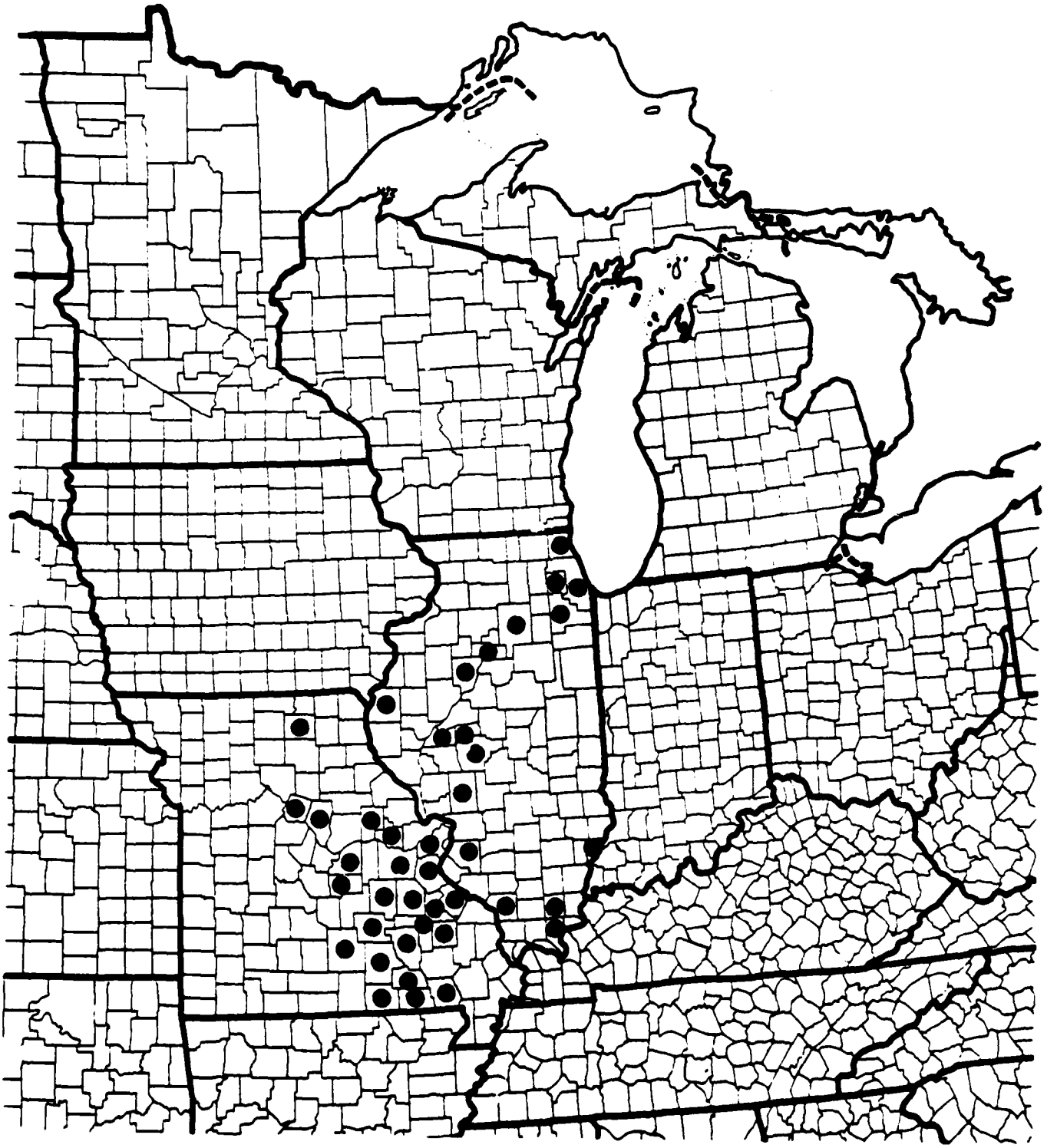
Distribution of Heuchera missouriensis in the bi-state area



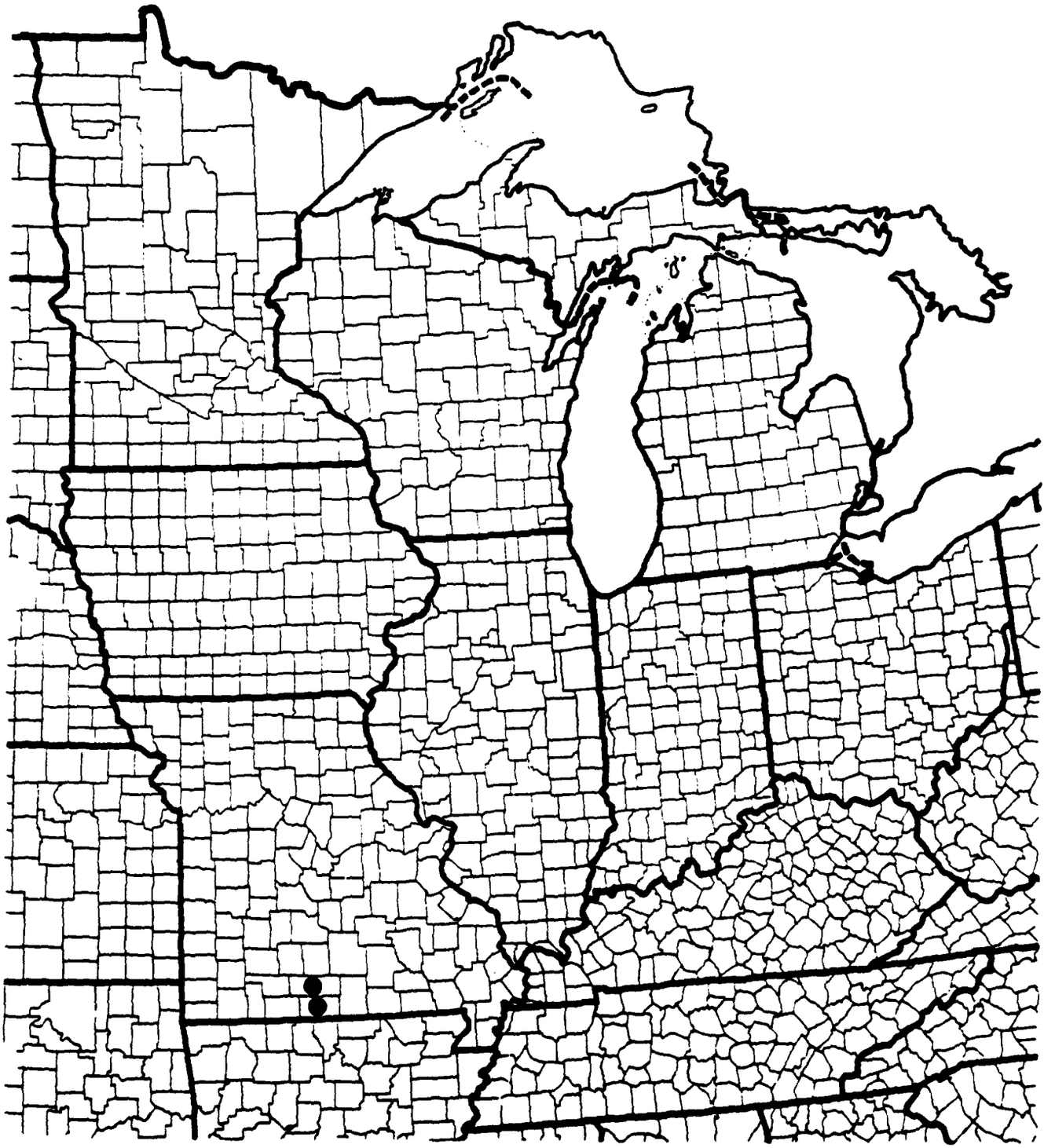
Distribution of Isotria medeoloides in the bi-state area



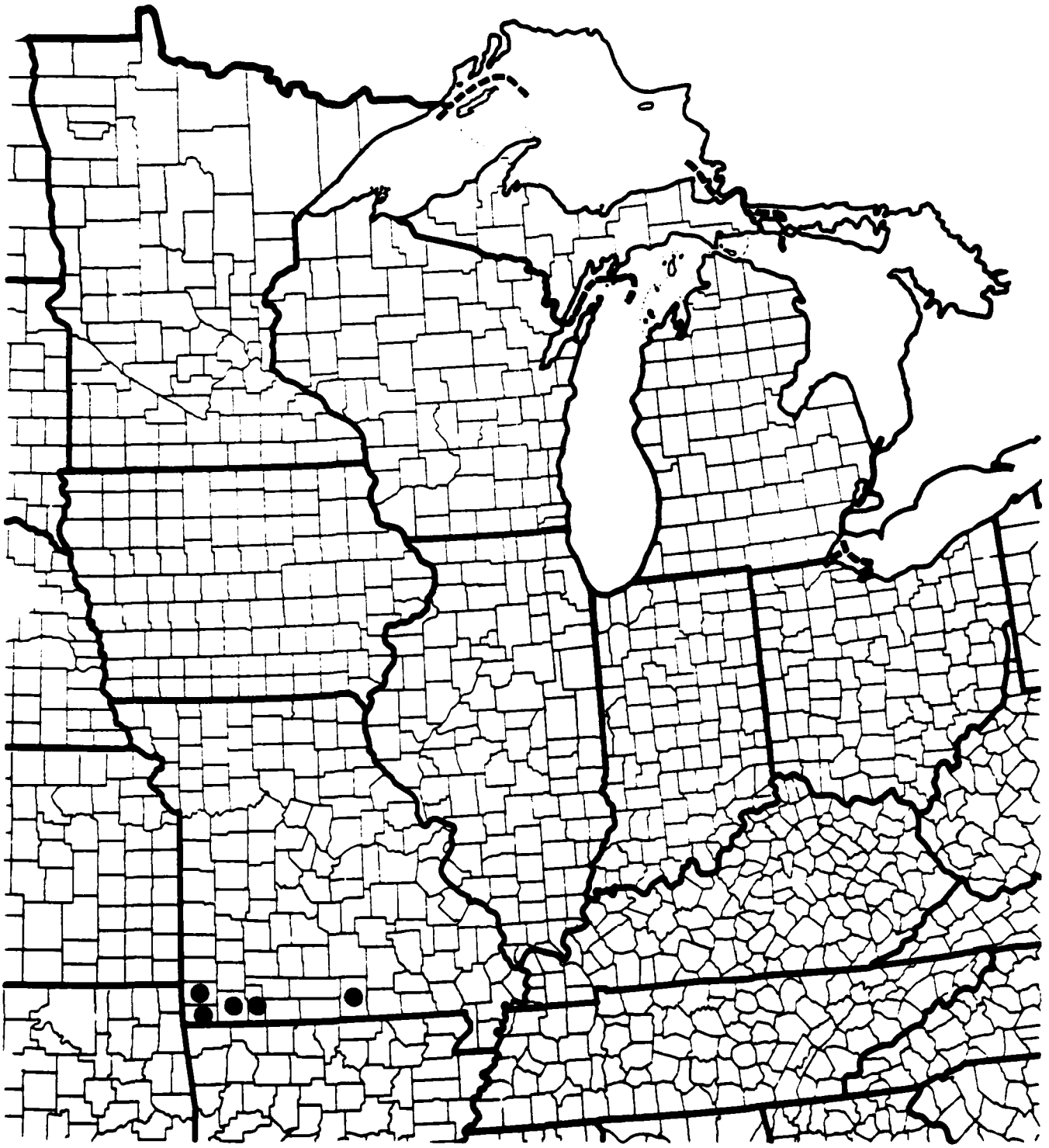
Distribution of Plantago cordata in the bi-state area



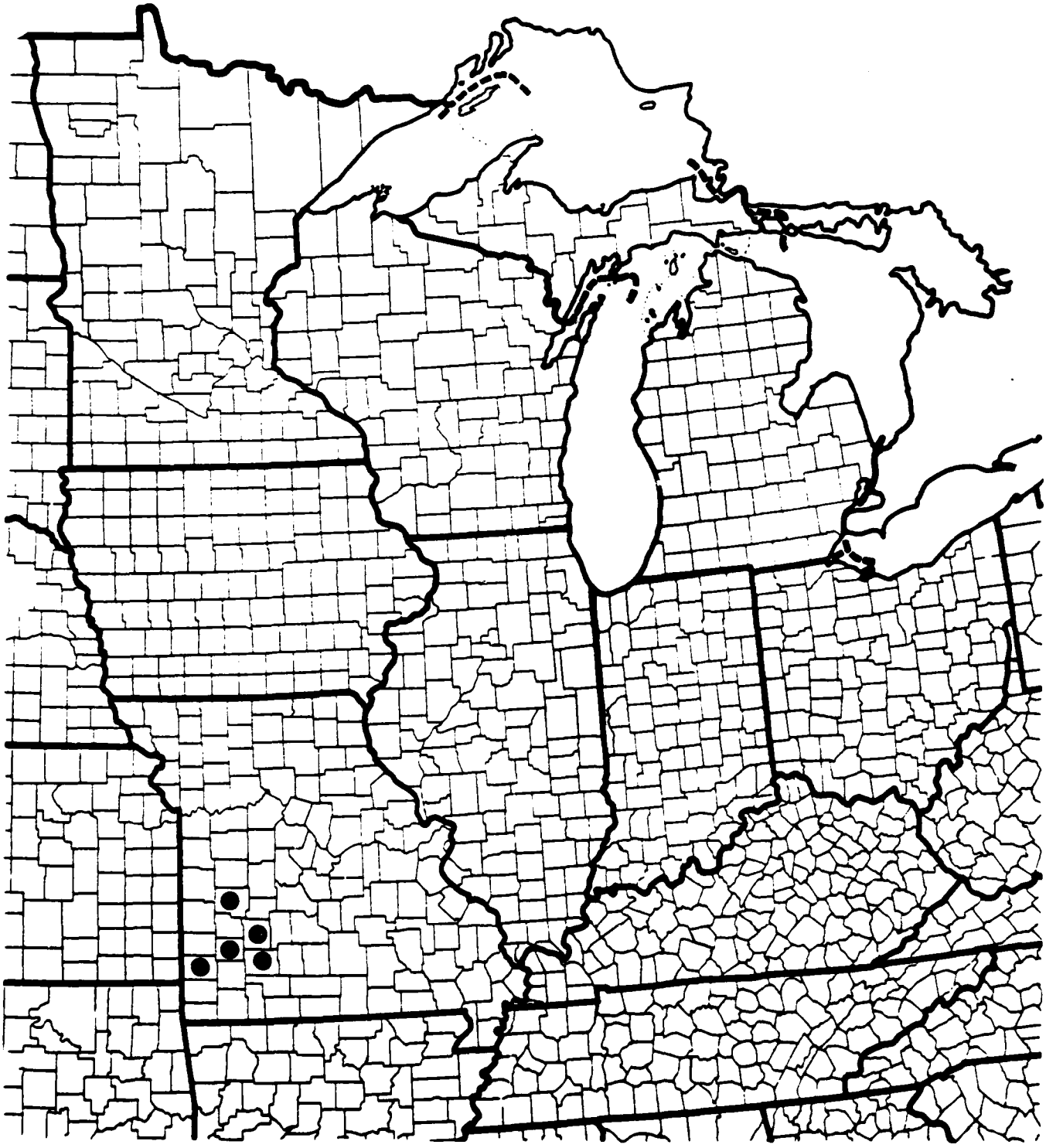
Distribution of Calamagrostis insperata in the bi-state area



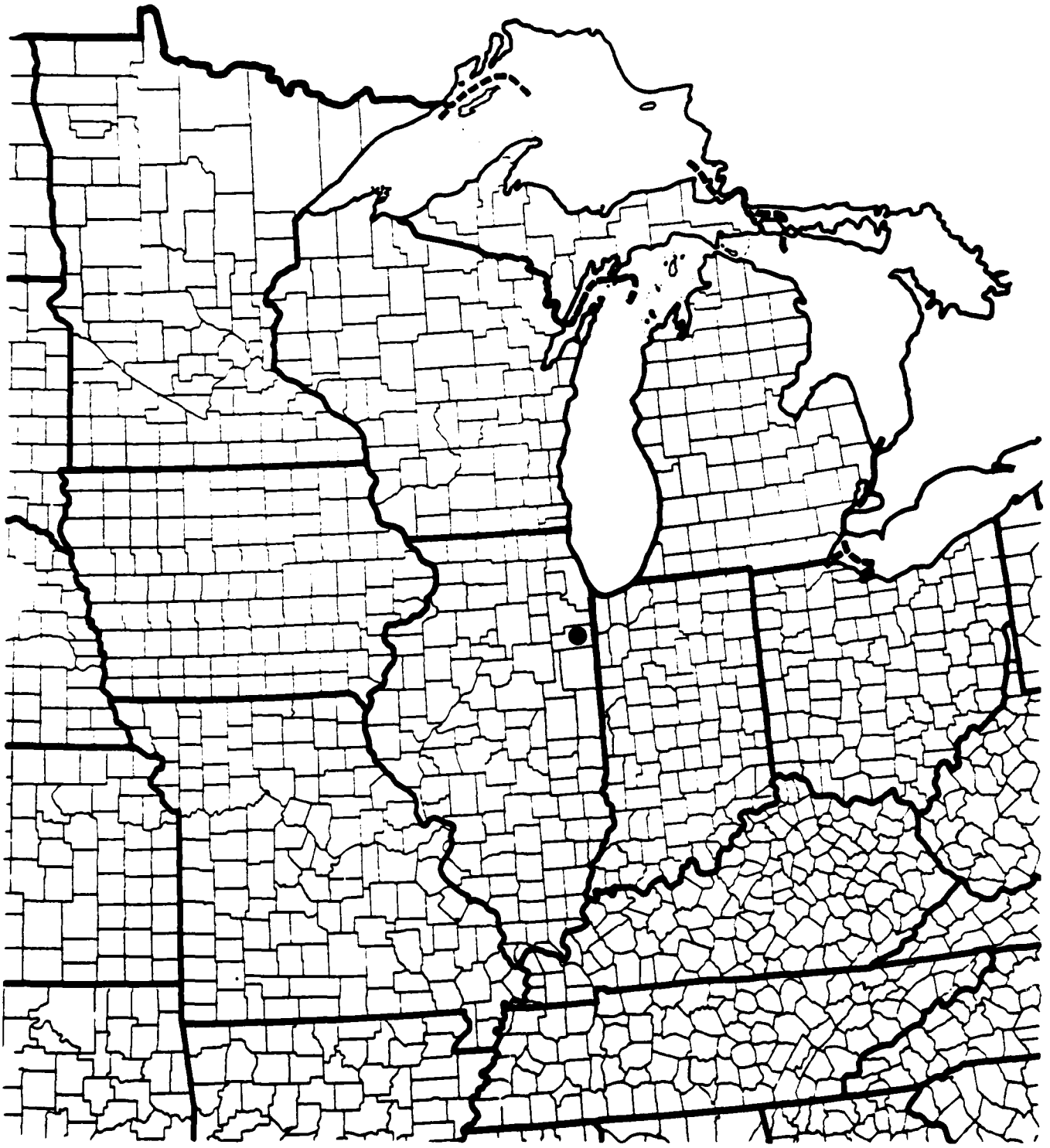
Distribution of Castanea ozarkensis in the bi-state area



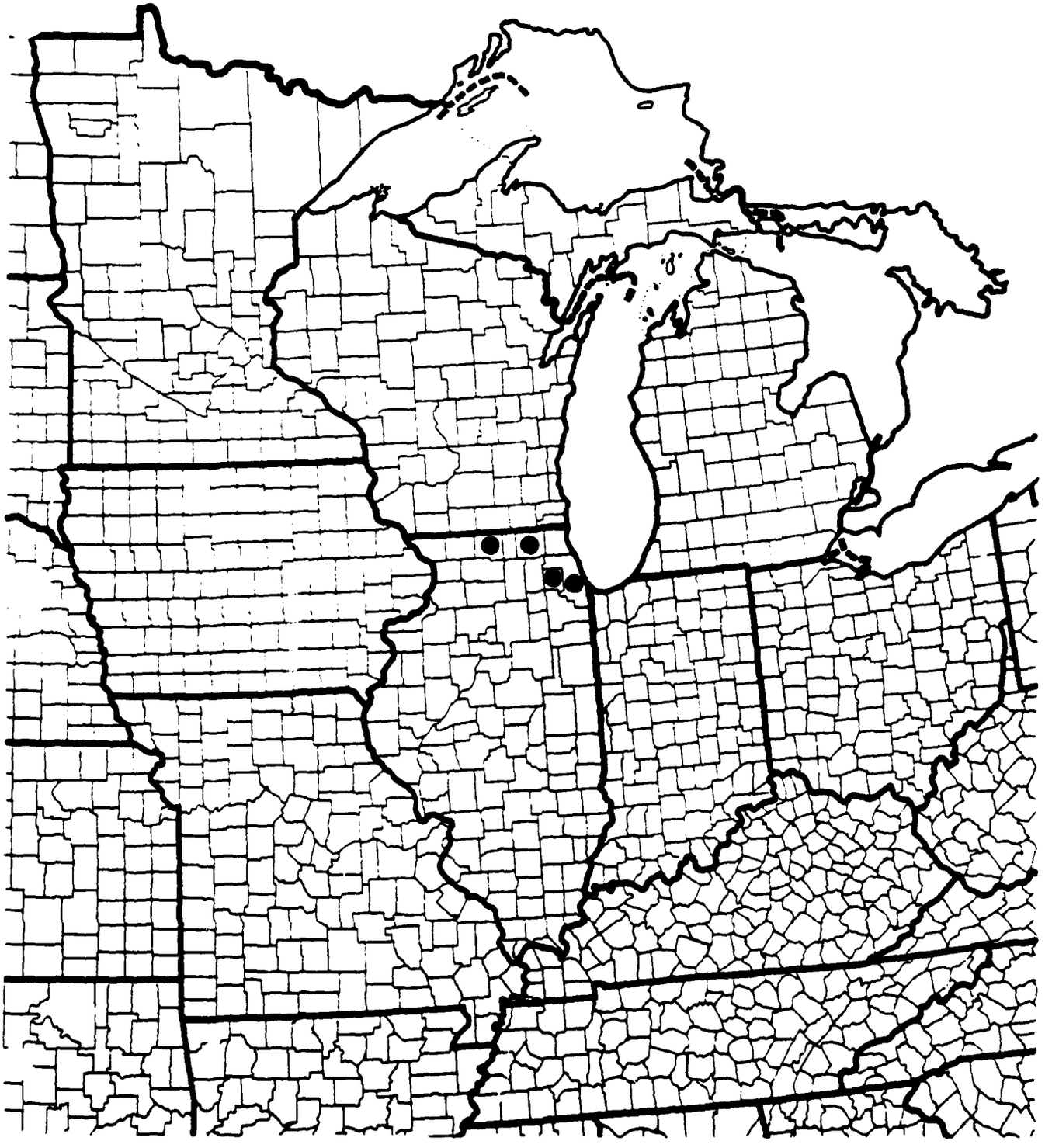
Distribution of Geocarpon minimum in the bi-state area



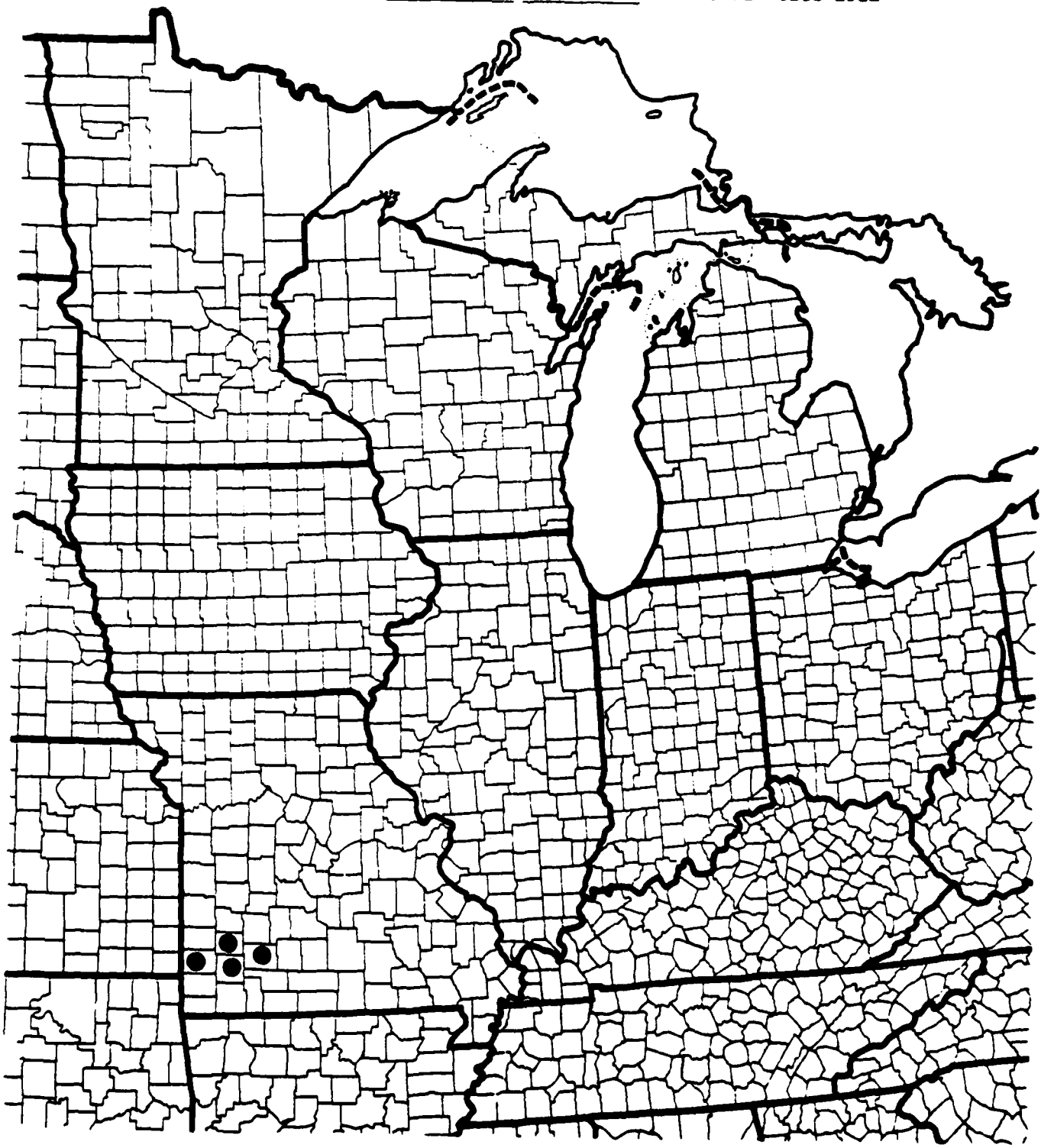
Distribution of Iliamna remota in the bi-state area



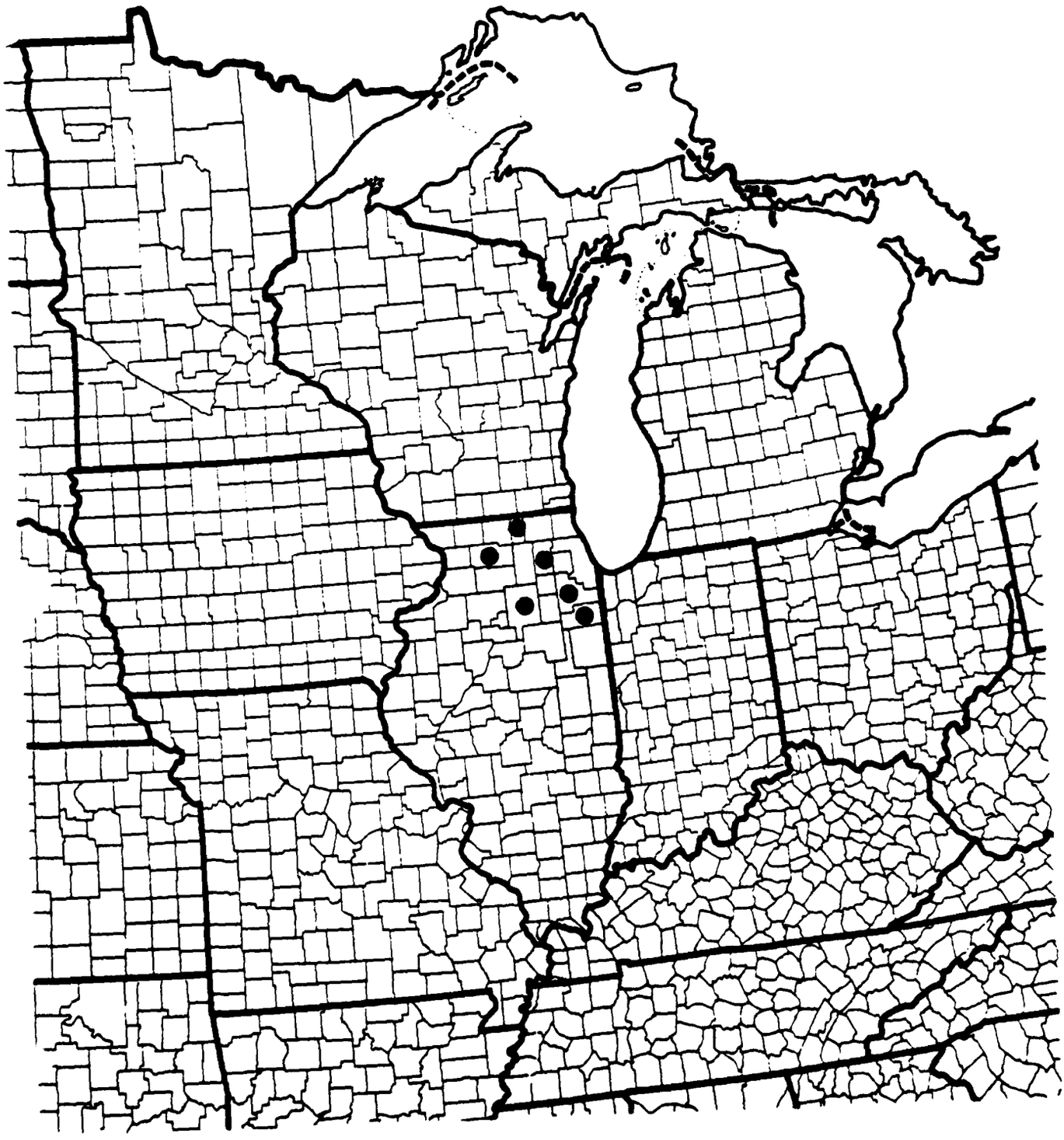
Distribution of Lespedeza leptostachya in the bi-state area



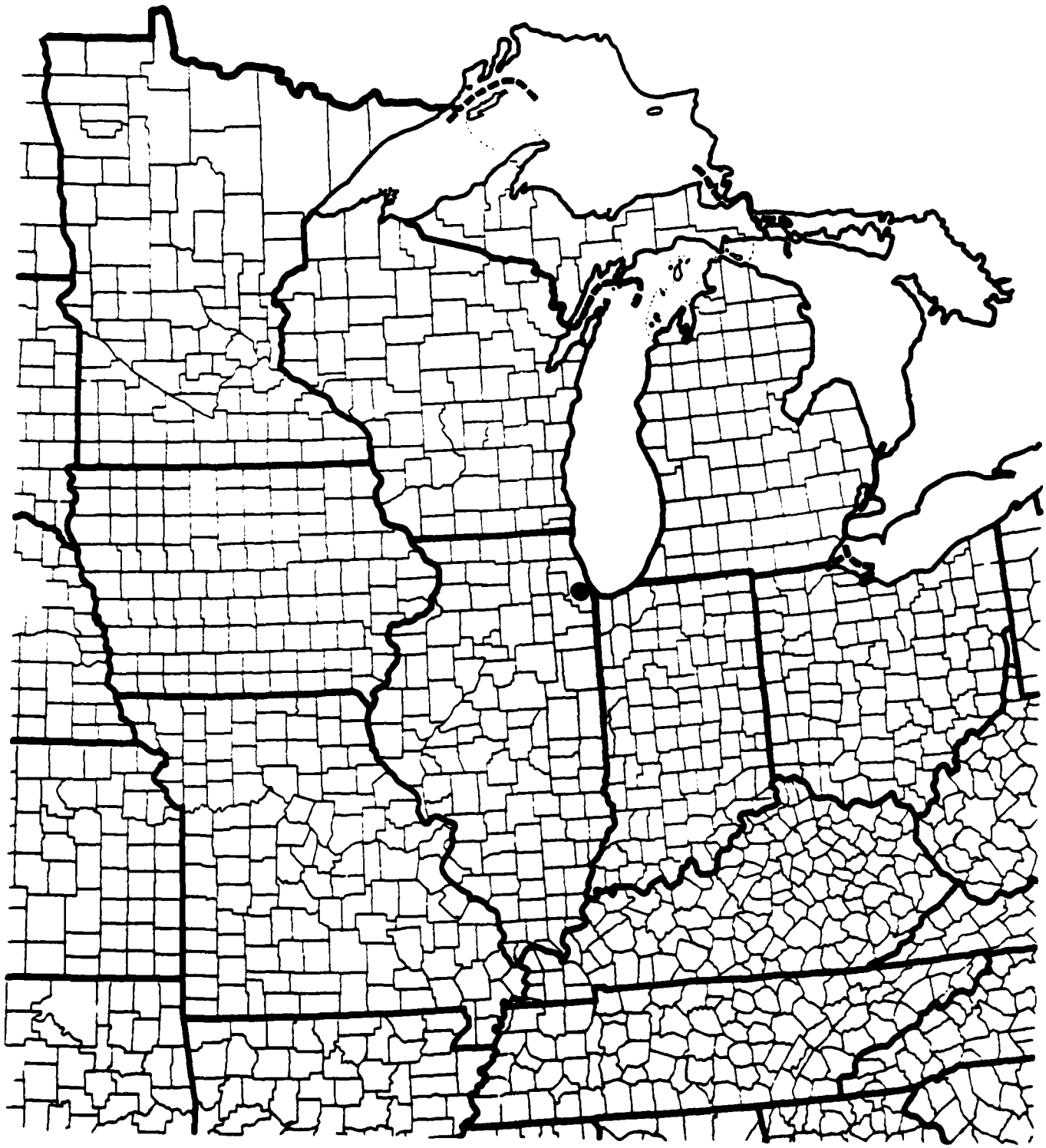
Distribution of Lesquerella filiformis in the bi-state area



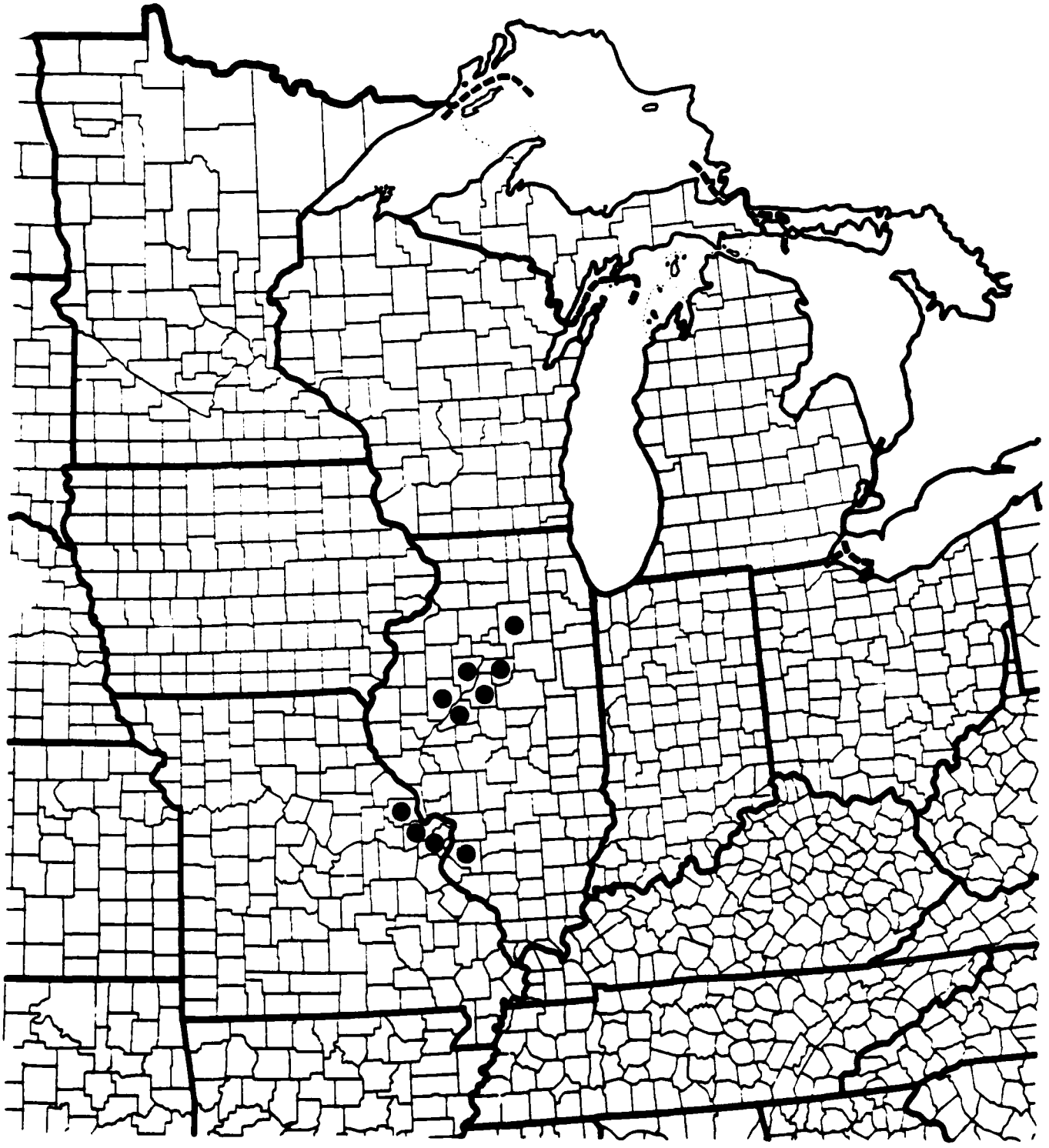
Distribution of Petalostemum foliosum in the bi-state area



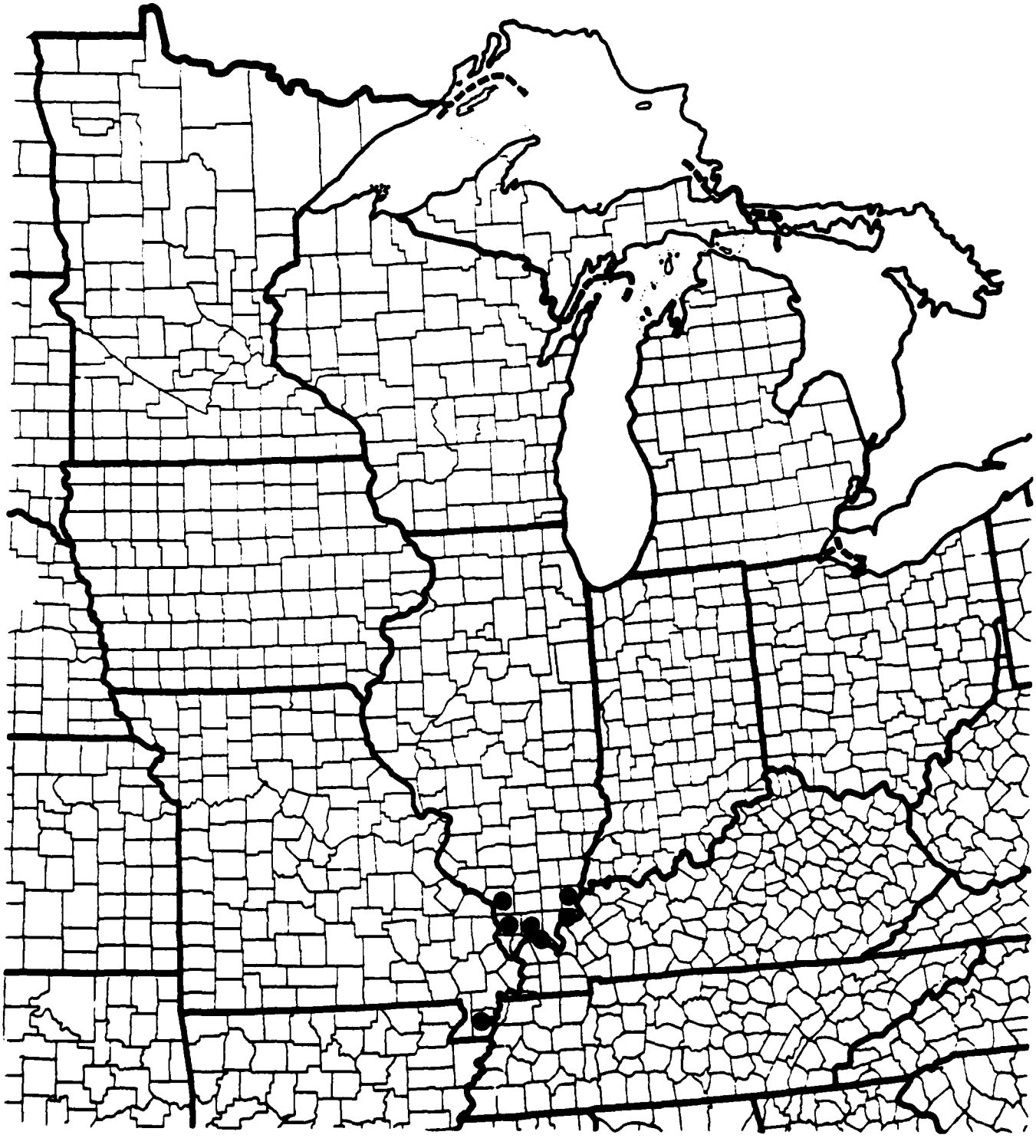
Distribution of Thismia americana in the bi-state area



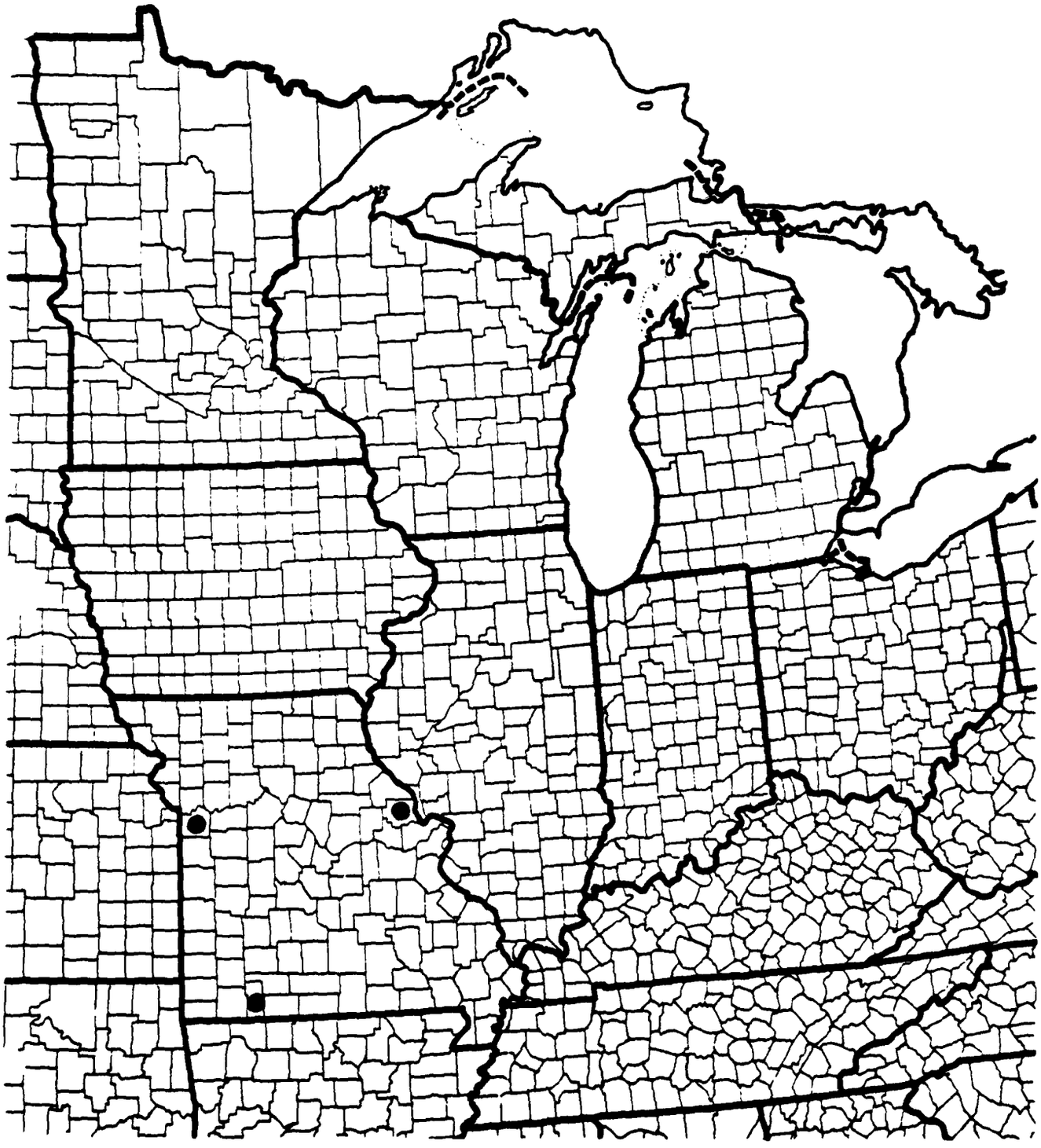
Distribution of Boltonia decurrens in the bi-state area



Distribution of Carex socialis in the bi-state area



Distribution of Rubus missouricus in the bi-state area



County Cross References
(extant localities only)

Illinois

Cass. *Cyperus grayioides*.
Jackson. *Plantago cordata*.
Randolph. *Isotria medeoloides*.
Union. *Apios priceana*.

Missouri

Dent. *Plantago cordata*.
Jefferson. *Plantago cordata*.
Madison. *Draba aprica*; *Heuchera missouriensis*.
Ste. Genevieve. *Plantago cordata*.
Warren. *Plantago cordata*.
Washington. *Plantago cordata*.
Wayne. *Heuchera missouriensis*.

Literature Cited

Anonymous. 1975. Report on Endangered and Threatened Plant Species of the United States. Presented to the Congress of the United States of America by the Secretary, Smithsonian Institution. U. S. Government Printing Office, Washington. 200 pp.

_____. 1976. Endangered and Threatened Wildlife and Plants. Department of the Interior, Fish and Wildlife Service. Federal Register 41(117):24524-24572.

D'Arcy, W. G. 1969. The Ozark Flora - Some Collections of Note. Annals of the Missouri Botanical Garden 56:465-467.

Swink, F. 1974. Plants of the Chicago Region. The Morton Arboretum.

Tessene, M. F. 1969. Systematic and ecological studies on Plantago cordata. The Michigan Botanist 8:72-104.

Correspondents

The following persons were asked to comment on the fifteen endangered species listed from Illinois-Missouri and to suggest other species which might be proposed for inclusion.

Dr. Robert Betz
Northeastern State University
Chicago, Illinois

Dr. William D'Arcy
Missouri Botanical Garden
St. Louis, Missouri

Dr. David R. Dunn
University of Missouri
Columbia, Missouri

Dr. John Ebinger
Eastern Illinois University
Charleston, Illinois

Dr. Robert A. Evers
Illinois Natural History Survey
Urbana, Illinois

Dr. Norlan C. Henderson
University of Missouri at Kansas City
Kansas City, Missouri

Dr. Robert Henry
Western Illinois University
Macomb, Illinois

Dr. Al Koelling
Illinois State Museum
Springfield, Illinois

Dr. Otto Ohmart
Southeast Missouri State University
Cape Girardeau, Missouri

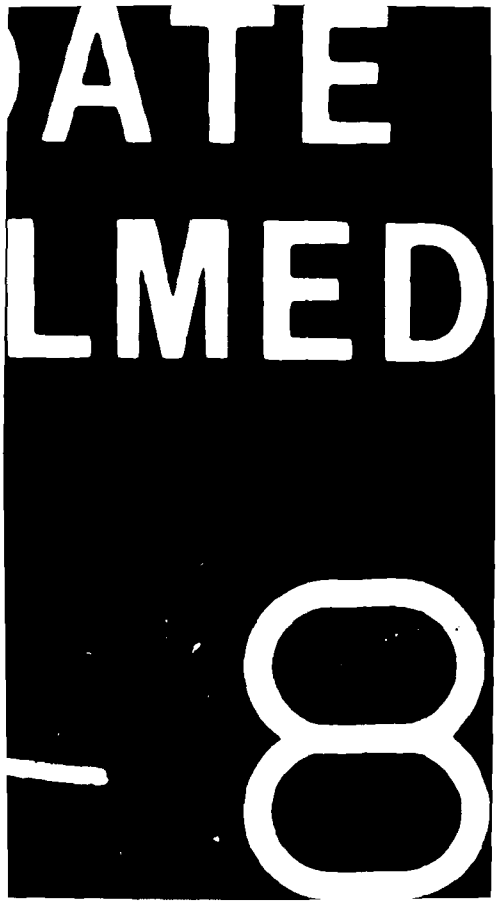
Dr. Paul Redfern
Southwest Missouri State University
Springfield, Missouri

Mr. John Schwegman
Illinois Department of Conservation
Springfield, Illinois

Dr. Paul Sorensen
Northern Illinois University
DeKalb, Illinois

Mr. Floyd Swink
Morton Arboretum
Lisle, Illinois

Dr. Wallace R. Weber
Southwest Missouri State University
Springfield, Missouri


ATE
LMED
8